

CUP-H05895-12-293464

THE
BRITISH JOURNAL
OF
EDUCATIONAL PSYCHOLOGY

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Vol. 42

12

Published by
SCOTTISH ACADEMIC PRESS, 25, PERTH STREET, EDINBURGH, EH3 5DW,
for the British Journal of Educational Psychology, Ltd.
Registered Offices : 8-24 Sampson Road North, Birmingham, B11 1BD. This address
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PRINTED BY THE BIRMINGHAM PRINTERS, LTD., 8-24, SAMPSON ROAD NORTH, BIRMINGHAM

293464

370.1505

B777

VOL. 42 Nos. 1-3

FEB - NOV. 1972

Sir CYRIL BURT



DORIS M. LEE

In the deaths, within a month, of Professor Doris M. Lee and Emeritus Professor Sir Cyril Burt, educational psychology in Britain has suffered a severe blow. The gap left in the ranks of senior workers in the field by the deaths during the past year of Professors Warburton, Wiseman and Veness, has now been so widened that it will be very difficult to fill. As is appropriate, their professional contributions have been publicly acknowledged in obituaries and in memorial services; it is, however, in families and small groups of close colleagues that bereavement is felt as much more than a formal expression of respect for a memory. The editorial board of the *British Journal of Educational Psychology* is one such group and we are very conscious of our loss.

Sir Cyril Burt had been a member of the editorial board of this *Journal* since it began in 1931; he had also been on the board of the old *Forum of Education* which replaced the *Journal of Experimental Pedagogy* in 1922 and which was eventually incorporated into this *Journal*. He was never really happy with the *Forum* which was an omnibus publication taking all kinds of papers on educational topics, and he had counselled Valentine, its editor, rather to continue with the old experimental journal while trying to increase the number of empirical papers so that its content would soon truly represent its title. Valentine decided to found the *Forum* because it seemed to him that it would be a very long time before there were enough good experimental articles in education to sustain a whole journal. In this he was mistaken, for, within five years of the publication of the first volume of the *Forum*, there were already complaints that space was inadequate for the publication of experimental work in education. A number of expedients were explored but a solution came only when Burt and Valentine worked out a scheme with the British Psychological Society and the Training College Association (now the ATCDE) for the metamorphosis of the *Forum* into the *British Journal of Educational Psychology*. When Valentine retired from the editorship 25 years later he lavishly acknowledged the part which Burt had played in the founding and guiding of the policy of the *Journal* as well as in contributing some 50 articles. With a new editor Burt might well have lost interest in the *Journal* but this was not so and when, five years later, I succeeded Vernon as editor, I found Burt my most valued adviser and friend. I called on him more than anyone else for advice and assistance and he always gave it with almost embarrassing prodigality.

As many know, this *Journal* is sponsored by two academic bodies, the British Psychological Society and the Association of Teachers in Colleges and Departments of Education. For convenience they established a non-profit-making limited liability company with shareholders and directors to own and publish the *Journal*. To begin with the management of its affairs was a comparatively simple task. There was, for a long time, no danger of making a profit. In fact, only by enlisting the help of his family and friends to share the chores of publishing and distributing it did Valentine keep it solvent in a period of great economic depression. By the end of the Second World War the affairs of the *Journal* had become much more complex, finances were on a much bigger scale and involvement with tax authorities and other officials under the Companies' Acts made it imperative that someone should take over the financial side of the Company who would develop the necessary knowledge to avoid such legal pitfalls as might ensnare the amateur, academic company directors. This was the rôle which Professor Doris Lee assumed for over twenty years, first as Treasurer and then as Secretary-Treasurer. She was ideally suited for it. Having come to educational psychology from a degree in mathematics and highly successful teaching experience, she soon developed a business acumen which was more than adequate to maintain the Company's affairs in a healthy state with substantial reserves favourably invested and the formalities imposed by the Board of Trade satisfactorily handled. At the same time she remained first of all an academic and progressively took more and more part in the evaluation and criticism of papers submitted for publication. When I assumed the editorship in 1962 I was greatly relieved when she agreed to join me as an associate editor, a position she still held under Professor Nisbet at the time of her death.

These two colleagues gave the *Journal* more than could really be expected of them and for no material reward. The whole community of educational psychologists is greatly indebted to them.

L. B. BIRCH.

SELECTIVE SECONDARY EDUCATION, SOCIAL CLASS AND THE DEVELOPMENT OF ADOLESCENT SUBCULTURES

By C. P. SPENCER

(Department of Psychology, University of Sheffield)

SUMMARY. From the results of a survey of the attitudes and values of 506 boys, aged 14–15 years in grammar and secondary modern schools, no support is given to either of two current hypotheses about home and school as socializing agents: that either the social class of origin or the type of secondary school attended provides the criterion for discerning the sub-cultures of this population. Nor does anticipatory socialization to the attitudes and values of the individual's expected socio-economic status occur. The variables used in some of the previous research on adolescent socialization, 'social class,' and 'type of school,' it is argued, are inappropriate even as summary variables: the differences in attitudes between types of secondary school, for example, are no greater than those between rural and urban schools; and to establish a norm for a particular type of school is to mask the wide variations existing between individual schools, and between streams within a single school.

INTRODUCTION

WHAT has come to be the received psychological theory of the processes of socialization has recently been criticised for over-emphasising the influence of the home, at the expense of neglecting the role of the school. Himmelweit and Swift (1969) trace this emphasis to developmental psychology's concern with early learning experiences in the family, and to sociology's focus upon sub-cultural differences in child-rearing techniques; and they attempt to redress the balance by providing a model of the socializing process which features the school as a major agent. Musgrove (1964), noting that much of the relevant literature relates to American samples, also stresses the importance of school in a country whose secondary education is selective, as is that in Britain. Indeed:

"In England, the tripartite system of secondary education has superseded family, friends and social class as the frame of reference from which the young take their bearings for their future lives and careers. Educational selection and segregation . . . provide (the young) with associates with similar aspirations from whom they can learn behaviour appropriate to their social and occupational goals."

Oppenheim (1956), reporting the results of a survey of 619 secondary school-boys, found that the type of school had a marked influence:

"Boys going to grammar schools or secondary modern schools do not merely acquire a different pattern of skills and knowledge, but they also acquire or maintain a certain outlook on life—a system of values which fits them for entry into the social level for which they are destined . . . the influence is largely informal, suggesting that the peer group plays an important part in the learning process."

Thus, it is claimed, one of the effects of selective secondary education is a more thorough re-alignment of the adolescent's values and attitudes away from social class of origin toward own future social class than occurs in a non-selective system. (Rogoff, in 1961, declared that in America, "The real focus of social mobility is in the living room, not the classroom.") Very early in his secondary school career, the British pupil replaces any fantasy aspirations by job preferences which are entirely realistic, given his likely qualifications and skills on leaving his particular type of school (Wilson, 1953, Liversidge, 1962). Type of school entered is not, of course, unrelated to social class of origin (see, for example, Douglas, 1964), but, the British workers maintain, from this point onward, the sub-cultures which should be discerned in adolescence and later are more determined by the school attended than by social class of origin. Himmelweit's longitudinal study (1954, 1964, 1969) has shown an effect of type of school lasting at least until age 30: "Analysis of the adult data confirmed the findings obtained in adolescence—namely that school rather than home affected the individual's subsequent occupational history, job level, and aspirations" (1969, p. 157).

These recent British surveys, in testing the applicability to Britain of American work on home and school, are perhaps in danger of establishing a new orthodoxy: in place of all-prevailing social class differences, the sub-cultures of a society practising selection in education are seen instead to be the groupings which follow from the process of selection, whether these groups exist in separate institutions or as separate streams within one comprehensive institution. Himmelweit herself characterizes the models presented as an oversimplification (1969, p. 160); it would thus seem worthwhile to establish the extent to which *either* home or school, as they have been characterized in the recent literature, exert an influence upon an adolescent's attitudes and values. The present study, therefore, undertook to investigate a wider range of attitudes and values than these surveys had done; and to examine the correlation of these with type of school attended, social class of origin and anticipated social class, in a population for whom school influence could be expected to be maximal: the last year of compulsory schooling, 14–15. Areas surveyed included aspirations and attitudes to the world of work and to the future; 'success' and its achievement (Katz, 1964, found social class differences in an Australian sample); relations with parents, adults in general, and other teenagers; life values and ambitions (cf Veness, 1962); qualities and characteristics of self and friends; social attitudes—current affairs, local and national priorities, race relations, religious and industrial behaviour. Previous studies—most notably that of Musgrove (1964)—have tended to discuss 'adolescent attitudes' in general on the basis of a survey concentrating mainly upon aspirations and job expectancies, which form a category of attitude somewhat apart from the rest of an individual's attitudes in that they are directly related to qualifications and experience gained from school. Given a wider range of attitudes surveyed, are the sub-cultures of adolescent society along lines determined by educational selection and segregation?

THE STUDY

Subjects.

506 boys, aged 14–15, formed the sample; they comprised fourth-form populations of 11 schools—four grammar schools and seven secondary modern schools, selected from schools in four contrasting local education authority areas so that in each region, grammar and secondary modern schools drew their pupils from approximately the same catchment area. Douglas's (1964, 1968)

sample is nationwide and representative ; other surveys quoted above tend to have been drawn from a single town or area. The present sample stands midway, drawing as it does from four different areas of the country : Home Counties suburban and rural area ; East Anglia rural area ; Midlands old industrial town ; and Southern new industrial town. Three further local education authority areas provided subjects at the pilot stages of the survey. In none of the areas were there, at the time of the survey, comprehensive schools of long enough establishment to warrant comparison with the established grammar and secondary modern school studies ; and only one of the authorities had any separate provision for technical secondary schools, as provided for in the 1944 Act. Hence, issues relating to type of school refer here, as in previous work, to the differences found between grammar and secondary modern schools.

Basic Sample Statistics

TABLE 1
BASIC SAMPLE STATISTICS.

	Grammar School	Secondary Modern
Total	175	331
Father's occupation :		
Middle Class	85	112
Working Class	81	197
Not known : unclassifiable	9	22
Own, anticipated job :		
Middle Class ..	132	119
Working Class	33	174
Undecided ; unclassifiable	10	38

Social class classification used the Registrar-General's 1966 Census categories ; correlational analysis retained each category ; but for the other analysis of responses, a grouping of categories was used, such that :

Middle Class : Registrar-General's I, II and III non-manual.

Working Class : Registrar-General's III manual, IV and V ; unemployed.

Instrument and Administration.

Pilot versions of the final questionnaire were compiled from a variety of sources including previous published surveys, with the majority of items arising from non-structured interviews and discussions with adolescents in the target age-group. (At this stage, too, several attitude areas tentatively included were omitted when it became clear that few of the age-group had formed opinions on the topic). Pilot work not only refined and tested content, but also sought the most convenient means of administration. The final version (see appendix) consisted of 54 items, mainly in open-ended form, and including eight factual items (father's job, family size, amount of pocket money and earnings received each week, plus items to screen for age and length of time at the particular school—subjects who had recently moved to the school being excluded from the analysis). Practical rather than theoretical considerations, determined the length and the group-administration of the questionnaire. The administrator was, in each case, introduced to each class by their headmaster by name, and as "coming to ask you some questions during the next hour" ; the master then withdrew, and a brief introduction was given, stressing the anonymity of the survey. No indication of the survey's main hypothesis was given at any stage.

Analysis.

Not until the survey was complete did coding of responses begin, with categories derived in part from the frequency of types of answers, use of key phrases by respondents, etc. ; and in part from the previous literature. Patterns of response were analysed by subgroupings of the total sample ; and by correlation, partial correlation and factor analysis. The subgroups of the sample investigated included :

- Grammar *versus* secondary modern school,
- Middle class *versus* working class father,
- and the four subgroups arising from the consideration of school and class of origin together,
- Middle class *versus* working class anticipated job,
- Rural *versus* urban schools (and for grammar school, secondary modern school separately),
- Stream within school, for grammar school, secondary modern school separately.

Tests of the significance of difference between subgroups of the sample used Zubin's (1939) test for differences between frequencies of events in two series of groups. In addition to analysing the distribution of responses in each subgroup, correlation matrices were obtained for the total sample, and for the sample with, respectively, type of school, social class of origin and anticipated social class partialled out. The total matrix was factor analysed, using a program developed by the Health Services Computing Facility, University College, London (version of April 25th, 1969) ; initial communality estimates were derived from squared multiple correlations and then the matrix was rotated to simple structure solution. Oblique rotation for simple loadings was performed with gamma equal to 0.0 ; the constant for eigen-values was 1.0.

RESULTS

For the present sample, neither social class of origin, nor secondary school attended can be defended as criteria for dividing the young adolescent male population into its subcultures. For any such claim to be sustained, the prospective subgroups (whether of social classes or of school groups) would have to exhibit significantly different means and distributions of responses on more than a bare minimum of response items ; correlation of social class or school with the attitudinal variables should reach some agreed minimum level ; and factor analysis of the matrix should demonstrate the centrality of either (or both) items in major factors. None of these occurs for the present sample.

Factor analysis (full details of which are given in Spencer, 1970) shows that, at age 14-15, expressed attitudes have a very weak structure ; only three factors of any significance emerge, together accounting for a mere 12.7 per cent of the total variance. The first factor, School and Anticipated Social Class, is of most relevance to the present purpose, for it indicates the isolation of the main independent variables from the attitude matrix.

Factor 1 : *School and Anticipated Social Class*

- +0.80 Anticipated school leaving date
- +0.68 Type of school attended
- 0.46 Anticipated social class.
- 0.43 Pocket money (Question 7)
- 0.33 Attitude towards stealing (Question 31)
- 0.31 Sociability of holiday activities (Question 25)
- 0.31 Father's social class.

The factor includes only one attitudinal item, attitude towards stealing; and demonstrates that the inter-relatedness of the independent variables is greater than their relationship with any attitude areas. The inter-relationship is expressed more clearly by the first entries on Table 2. Correlational analysis further serves to illustrate the relative isolation of the independent variables from the rest of the attitude matrix. Table 2 lists all correlations with Social Class of Origin and Type of School which are greater than $r = .10$ for one or other independent variable.

TABLE 2
MAIN CORRELATES OF SOCIAL CLASS OF ORIGIN, AND OF TYPE OF SCHOOL.

	Social Class of Origin	(With School partialled out)	Type of School	(With Class partialled out)
Principle variables and aspirations:				
Type of school.....	.18	(0)	—	—
Social class of origin	—	—	.18	(0)
Anticipated social class ..	.24	.19	.44	.43
School leaving date	— .23	— .15	— .67	— .66
Level of job considered unacceptable (Q.19) ...	.11	.07	.26	.25
Chances from this school (Q. 18)	.10	.08	.15	.13
Activities, etc.:				
Sociability of holiday activities (Q. 25)	.06	.01	.30	.29
Holiday with parents (Q. 22)	.18	.18	.07	.04
Pocket money	.16	.12	.27	.21
Attitudes:				
To fighting (Q. 45)	.14	.11	.18	.16
To foreigners (Q. 42) ...	— .08	— .06	— .10	— .09
To stealing (Q. 31)	.15	.14	— .08	— .06
To parents' advice (Q.20)	.12	.12	.05	.02
To adults in general (Q.21)	— .08	— .06	— .14	— .13
To leisure activities (Q.23)	— .11	— .11	— .01	0
Changes desired in G.B. (Q.34)	— .16	— .13	— .20	— .18
"One law for the rich."				
(Q.38)	.02	0	.12	.12

NOTE: The remaining 34 items of the matrix have correlations of less than $r = .10$ with either Social Class of Origin or Type of School.

The primary result to be noted from Table 2 is how few of the 51 variables included in the correlation matrix are included in a table whose lower cut-off point is set at a modest $r = .10$; and how few of those items which do meet this criterion are attitude items. Among those attitudes that are found to be related to Social Class of Origin, little pattern is discernible: attitudes to fighting and to stealing might be postulated as an orientation toward 'traditional values' which differentiate the social classes. This would be to ignore, however, other similar items included in the questionnaire which show no such correlation with social class, as well as to overstate the importance of these particular correlations.

The list of items related to Type of School is even more heterogeneous in its inclusions and exclusions: included are attitudes towards fighting (again), towards adults, and to changes desired in Great Britain; but items of similar content fail to achieve any such relationship. The seemingly strong relationship of Type of School with 'sociability of holiday activities' is almost entirely accounted for by the strong tradition among the secondary modern school sample of working in the holidays. This, in its turn, is reflected in the remaining item, pocket money and earnings, where there are significant differences between types of school, as well as being strong social class differences in income: working class boys, in both types of school, command considerably larger monies than do middle class boys.

Partial correlation shows the influences of Social Class of Origin and Type of School to be largely independent of each other, both on the items tabulated and on those where the correlation is lower than $r=.10$. However, the lack of any consistent pattern among the correlates of either main variable, and the weakness of the relationships that do exist, argue against considering either variable as influences at all.

TABLE 3
MAIN CORRELATES OF ANTICIPATED SOCIAL CLASS.

	Full correlation	With School and Social Class of Origin partialled out
Principle variables and aspirations:		
Type of school	.44	—
Social class of origin	.24	—
School leaving date	— .49	— .27
Level of job considered unacceptable (Q.19)	.20	.09
Chances from this school (Q.18)	.12	.04
Anticipated income (Q.12)	— .23	— .20
Family size	.17	.16
Activities, etc.:		
Sociability of holiday activities (Q.25)	.14	0
Pocket money	.11	— .01
Attitudes:		
To fighting (Q.45)	.12	.01
To adults in general (Q.21)	— .16	— .10
To teenagers (Q.37)	— .11	— .12
To parents' help (Q.27)	— .11	— .12
To a friend (Q.54)	— .07	— .12
To authority (Q.36)	.13	.14
Changes desired in G.B. (Q.34)	— .23	— .14
"The worst thing one could do" (Q.47)	.17	.12
Sport <i>versus</i> reading (Q.50)	.12	— .07

NOTE 1: The remaining 33 items of the matrix have correlations of less than $r=.10$ with Anticipated Social Class.

NOTE 2: 48 members of the total sample did not have any definite choice of job, and are thus excluded from the present analysis.

Anticipated social class might well be postulated as a more realistic criterion for the discernment of sub-cultures in an adolescent sample, some of whom were only weeks away from their first full-time employment. In view of the realism

of job choices in this and earlier surveys (e.g., Wilson, 1953; Liversidge, 1962; Morton-Williams and Finch, 1968), it might be assumed that, by a process of anticipatory socialization, adolescents came to assimilate the attitudes and values of the social class they were likely to enter (cf. Musgrove, 1964, quoted above). Thus, anticipated social class would not only be a summary of the career influences upon the individual (including both type of school and social class of origin), but also, more importantly be a self-defining characteristic of the individual: this is what he is shortly expecting to be. Veness (1962), Liversidge (1962) and Musgrove (1964) have indicated the power of this realisation to shape the individual's attitudes to work. Table 3 shows how far this is true of a wider range of attitudes.

Comparison of full and partial correlations in Tables 2 and 3 indicate that Anticipated Social Class is only in part a summary variable for the combination of Type of School and Social Class of Origin: in comparison with either, it is somewhat more central to the attitude matrix, but still remains essentially unrelated to the majority of items included in the survey. Adolescents may have, at age 15, anticipated their future jobs and incomes, but clearly have yet to adopt attitudes characteristic of their future socio-economic status. Detailed examination of the (potentially) socially mobile within the sample (Spencer, 1970) shows little evidence of attitudes and traits often associated with (actual) social mobility (e.g., Hyman, 1953; Christiansen, 1959; Douvan and Adelson, 1958).

Analysis of the distribution of responses by subgroups of the sample was the final mode of whole-sample analysis. Whilst it enables one to examine some items excluded from factor and correlational analyses because of their non-scalar nature of coding, and is a more appropriate method for investigating type of school differences, this method provides little more justification for regarding social class or type of school as important variables *per se*. There are, in addition to the differences adducible from the tables of correlation, a few further significant differences to be noted. The middle class boy is more likely to choose a job for altruistic reasons than is the working class boy ($P < .05$); the grammar school boy is more likely than the secondary modern school boy to define success in terms of money ($P < .05$), and less likely to seek a job in terms merely of its interest to him ($P < .05$); anticipation of middle rather than working class job is significantly associated with more pro-immigrant views expressed in answer to Question 28 ($P < .05$). The remaining items again show no significant differences between any subgroupings of the sample.

DISCUSSION

Are the social classes in Britain today, or alternatively the pupils in different types of secondary school, the distinct adolescent sub-cultures that the two 'traditions' concerning adolescent socialization suggest? As strongly as it is ever possible to present a case with negative data, the indications of the present survey are that no such sub-cultures exist at age 14-15. The influence of home and of school upon an adolescent's attitudes and values are undoubted, and comprehensively documented; what is at issue is whether these influences are adequately or realistically summed up by the type of portmanteau variable—'social class,' 'type of school'—that has most frequently been used in such investigations. Broad similarities may exist between the attitudes and behaviour of members of a particular social class (e.g., Centres, 1949; Klein, 1965), and serve to add colour to descriptions seeking to characterize differences between the social classes. Similarly, broad similarities may be found among schools of one type, and broad differences between types. But the range within any one

subgrouping, of schools or social classes, and the degree of overlap between sub-groups makes the identification of 'social class,' or 'type of school' as an influence upon (or merely a correlate of) attitudes and values a dubious process. The status and usefulness of the concept of social class in social science research has frequently been questioned (e.g., in two contrasting fields, Lockwood and Goldthorpe, 1963; Morrison and McIntyre, 1971); and the difficulties involved need no further rehearsal. However, less critical attention has been given to the variable 'type of school,' and the reasons why no substantial type of school difference emerged in the present survey are perhaps worth consideration.

The 'type of school' variable in this and other related research has taken the types of school as given by the 1944 Education Act, the two main categories of which, grammar and secondary modern, are distinguished by (broadly), intellectual ability of intake, and academic nature of the curriculum. Hence attitudinal correlation with a 'type of school' variable may well be traceable to these basic differences in intake and curricula. But, in addition, grammar and secondary modern schools are (again broadly) distinguishable by other features which are incidental to, or even inimical to the conception of the schools: size, provision of facilities, prestige in the community among parents, employers, and among the pupils and teachers themselves (e.g., Oliver and Butcher, 1968). The social class composition of schools varies considerably; and this factor Coleman (1961) has been able to relate to differences in value climate between schools. In the present sample, the total grammar school population contained 49 per cent middle class of origin and 45 per cent working class, as against the total secondary modern population's 34 per cent middle class and 59 per cent working class. (In both types of school, there was insufficient information on father's job to give a definite classification in 6 per cent of cases). Even within this sample, which did not include any notably one-class schools, there are considerable variations about these averages for particular schools and, therefore, it would be necessary to control for the effects of social class composition before making statements about the influence of type of school. Partial correlation, as carried out in the present analysis, represents only one step in this direction: in addition, it would be necessary to use schools matched according to composition of intake.

There exist still more serious criticisms of the practice of considering all grammar schools together as one category, and all secondary modern schools together as another. Research on educational attainment has suggested that type of school may be less important than whether a school is urban or rural, streamed or mixed-ability, large or small, mixed or single-sex, broadly democratic or autocratic (e.g., Dale, 1969, 1971; Wilson, Williams and Sugarman, 1967); and such factors may well be as relevant to the expressive culture of the school attitudes, values, behaviour, as they are to its instrumental culture (cf. King, 1967). The most striking difference of all between schools to the investigator moving round many schools is also the least measurable feature: the individual ethos of each institution, its own climate of opinion, norms for behaviour and for the expression of individuality, sometimes traceable to avowed policy, sometimes to the influence of a particular individual, sometimes to physical and architectural features.

Using the present study, it is possible to begin illustrating the influence of such variables which, in their turn, militate against taking a simplistic view of differences between 'types of school.' The effects of three variables—rural/urban catchment area; stream within school; and school ethos—will be briefly considered.

Both grammar and secondary modern samples were subdivided into rural and urban pupils; and the responses on each item were compared. As noted earlier, only weak grammar/secondary modern school differences had been found; cutting across these, the rural-urban variable presents a rather altered picture of the sample. As against the few variables significantly distinguishing all grammar from all secondary modern pupils, 28 items distinguish rural from urban pupils; and—looking at rural-urban differences within type of school (i.e., identifying whole schools as predominantly urban or rural, rather than analysing by individual pupil's home)—13 of the items previously found to be related to type of school differences do not recur at the same level of significance when the rural-urban variable is held constant: i.e., partialling out the rural-urban variable indicates that the original type of school differences noted are, in part, compounded with the rural-urban variable (cf. Swedner, 1960). Tabulation of results is not appropriate here, as the number of subjects in one cell is small; the main purpose of this particular analysis was to illustrate that at least as great differences might be found between rural and urban subjects as between grammar and secondary modern school subjects; and that *neither* variable should be conceived of or investigated in isolation from a range of other, interacting variables. Morrison and McIntyre (1971), reviewing recent literature on the role of schools in socialization, argue that it is vital to place educational influence into its proper perspective, and to appreciate its limitations. Setting it against a very broad and crudely delineated ecological variable, such as the rural-urban dichotomy, and finding it no more influential, represents one way of doing this. What have been in earlier surveys represented as grammar and secondary modern school norms can be, in part, traced to the summation of two separate subgroups' norms: that of the urban species of a type of school, and that of its rural counterpart.

Similarly, another subgrouping of the present sample—stream within school—can be used to illustrate the misleading effects of looking for a whole 'type of school' variable. If one of the basic reasons for the differences between the types of school were to be differences in average intelligence of intake, then, by the same argument, there should also be found differences in attitudes and values between, say, top and bottom streams in the secondary modern school, which are also widely separated by intelligence level. Analysis of responses from these particular subgroups of the present sample was performed—all seven schools being streamed by, among other things, measured intelligence. Again, as cell sizes are not large, and so that too much emphasis should not be placed upon the actual statistics, only the overall result of the analysis is given here. On two-fifths of the items covered in the survey, there emerge significant differences between top and bottom streams of the secondary modern school sample, with the top stream being considerably skewed toward the overall grammar school norms. Hence, if one were to present an overall norm for a type of school, this represents the summation of what could equally well be defended as a series of norms corresponding to each stream or form within that school. Indeed, impressionistic evidence on the effects of streaming on attitudes (Jackson, 1964; Hargreaves, 1967) suggests that positing norms for particular streams may be considerably more realistic than describing them for a total organisation.

Finally, the factor which is most difficult to describe, let alone put into a form whereby different schools can be compared: the ethos of a particular school. For the present illustrative purpose, only one element of the total ethos of one particular school in the survey will be discussed. One of the

secondary modern schools in the sample had, over six years, conducted study projects on world citizenship. This involved each class, all teachers, a three-week period of intensive project work by the whole school in summer, and a culminating 'Study Day' named after the particular aspect of citizenship focused upon during the year—e.g., Race, World Want, One People: an experiment in education in world citizenship which the school regarded as unique. If one compares the responses given by pupils at this school against the overall secondary modern school norm for items concerning foreigners, Britain's role in the world, and immigrant housing, one can demonstrate that the school has a definite style of response which sets it off from other secondary modern schools: more liberal on the first two items and (in striking contrast) much less liberal on the issue of housing. (32 per cent of pupils in the other six secondary modern schools would allocate a house preferentially to immigrants, compared with only 8 per cent of the present sample advocating doing so). The school's study projects and its parent community's growing 'immigrant problem' (greater here than in the other three areas under study) can thus both be seen as influences upon this particular subsample's attitudes to the various items.

For each particular school, responses to any item must be the product of many such varied influences as the two illustrated in this last example. To then summate the responses across different schools in order to establish a 'type of school' norm is, surely, to adopt the wrong strategy for investigating the genesis of adolescent attitudes. Social surveys must necessarily use broad summatory variables, such as 'social class' or 'type of school'; yet, in doing so, they not only must omit to investigate very individualistic influences—the role of a particular teacher, for example; but also, they are in danger of arriving at essentially specious results, wherein a loose pattern of very weak positive correlations, such as the present survey found associated with 'social class' and 'type of school,' is elevated into the position of being evidence of the role of family, or school, as a socializing agent. The social survey can only be the beginning of such a model building exercise, not its main tool.

ACKNOWLEDGMENTS—I would like to thank the directors of education, headmasters and pupils in seven local education authority areas for their co-operation in this study; the Medical Research Council for a studentship for training in research methods; Miss Betty Swift for her computational expertise and assistance; and Professor Henri Tajfel and Mr. Michael Argyle for many helpful discussions at various stages of this research, which forms part of a thesis for the degree of D.Phil., Oxford University.

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(Manuscript received 1st May, 1971)

APPENDIX

THE QUESTIONNAIRE

1. How old are you?
2. When did you first come to this school?
3. Where do you live?
4. Have you always lived there? (If not: where before that?)
5. What is your father's job?
6. How many brothers and sisters have you?
7. How much pocket money and other money or earnings do you get each week when you are at school?
8. When do you expect to leave school?
9. What job would you like to have?
10. Why would you choose this?

Ten years from now, you will be nearly 25. Imagine your life then:

11. Where will you live?
12. What will you be earning?

13. What will you enjoy most about this time ?
14. When people talk of a man as being successful in life, what do they normally mean ?
15. Why do people get the kind of jobs that they do ?
16. How do people get to the top ?
17. When you look around at people who have done well, who have got on, how do you think that it has happened ? How do you think they manage it ? By hard work ; by being lucky ; by being good at their job ; by knowing the right people ; all of these : or what ?
18. What are the chances for someone like yourself from this school to get ahead if he really sets his mind to it ?
19. Some people here will not have such a good job by the time they are 30. What do you think they will be doing ?
20. Do you think that parents should advise their children about the sort of work they should do ? Yes/No .
21. Would you say that very few adults really understood teenagers ?
22. This year, will you be going on holiday with your parents, with friends, with the school, alone, or not at all ?
23. What things do you do here at school after lessons ?
24. Do you have one set of friends here and another out of school ?
25. How do you spend your time in the holidays ?
26. Among your friends, is there one you discuss important things with ?
27. If you have an important problem, would you ask this person's advice, or your parents ?

Imagine now that you are in the situations I am going to describe ; it might be a job, it might simply be something you had to deal with.

28. You are in charge of housing here in (insert the name of the town or area). You have one house to let at present, and two families want it. These families have both just arrived here, looking for work. Both families have two small children. One has come from the North of England, the other from Jamaica. Neither has anywhere to stay. Which will you let the house to ? Will you need to ask any more questions about them ?
29. You are Chancellor of the Exchequer, and this year find that you have balanced the country's budget so well that there are several million pounds to spare. How should this be spent ?
30. You are married, and have a son of 15 who goes out most evenings without telling you where he is going. Should you try and find out ? Should you try to make him stay in more with the family ?
31. At work, someone shows you away of getting something for yourself, without anyone noticing. What will you do ?
32. Suppose you could have either a job where the money was not good, but you were helping people, or a job where the money was good, but you didn't do things for people in it. Which would you rather have ?
33. What are you most proud of being ?
34. What would you most like to see changed in Britain ?
35. "A man who commits murder is not fit to live." Agree/Disagree.
36. " You don't need a parson to tell you the difference between right and wrong." Agree/Disagree.
37. " To-day's teenagers are very different from teenagers in the past." Agree/Disagree.
38. " In this country, there is one law for the rich and another for the poor." Agree/Disagree.
39. " There is no harm in travelling without a ticket occasionally if you can get away with it." Agree/Disagree
40. " Most adults say one thing and do another." Agree/Disagree.
41. " Britain should look after her own problems and let other countries deal with their own." Agree/Disagree.
42. " Foreigners should stay in their own country." Agree/Disagree.

43. Why do people go to church ?
44. Whose fault are strikes ?
45. When is it right to start a fight ?
46. Think of the type of person you admire most. What is it about them that you admire ?
47. What is, positively, the worst thing you could do ?

A few minutes ago, I asked you to imagine that you had a son of 15.

48. What would you like to see him do in life ?

Would you rather he :

49. Were good at sport or popular with everyone ?
50. Spent most of his time reading or spent most of his time at sport ?
51. Was likely to end up with an important job or was likely to be happily married ?
52. Was like you or unlike you ?
53. Why ?
54. Complete the following sentence : "A good friend is one who . . ."

THE DEVELOPMENT OF ESN CHILDREN'S UNDERSTANDING OF CONSERVATION IN A RANGE OF ATTRIBUTE SITUATIONS

By CAROLINE M. LISTER

(Department of Psychology, University of Keele)

SUMMARY. 115 children from an ESN school were pre-tested on Piaget-type conservation tasks involving seven different attributes: number, substance, length, distance, area, weight and volume. 51 of these children, who failed to conserve in relation to two or more attributes, were studied further. Aged 10 to 16 years, IQ 50-77, they were divided into three groups matched for age, IQ and level of initial understanding of conservation. One group was instructed on conservation of a variety of attributes, a second group on conservation of area only; and the third group was given practice in reading. Post-tested after one week and then two months, 30 of the 34 instructed children consistently recognised, generalised, and gave reasons for conservation on both post-tests. No control child improved in understanding of conservation by the time of the second post-test.

INTRODUCTION

THIS investigation followed previous work on ESN children's appreciation of conservation of quantity and its development by instruction (Lister, 1969, 1970). The present study used an enlarged sample of pre-test problems, 14 in all, in order to illumine four main questions. (1) Is appreciation of conservation systematically related to the attribute under consideration? It has been found that almost without exception ESN children appreciate conservation of substance before weight before volume (Lister, 1970). Can this developmental sequence be replicated and extended to include the attributes of number, length, distance and area? (2) What is the influence of specific task variables? Whether a child appreciates conservation can be assessed only from his performance on actual problems involving specific materials, transformations, words, gestures, etc. There is good reason to suppose that such specifics affect the child's appreciation of conservation. Can anything of a general kind be said about the influence of these specifics? (3) Following pre-testing, two contrasting schemes of instruction were used. How effective are they, and does effectiveness depend on the child's initial level of understanding, as indicated by his performance profile on the pre-test? (4) Do any effects of instruction generalise to problems not used in instruction and, if so, what is the extent of this generalisation?

PROCEDURE AND RESULTS

The subjects were 115 children drawn from a school for ESN children. They were aged 8 to 16 years with IQs (supplied by school records) from 47 to 81. None had taken part in previous investigations by the writer. Each child was pre-tested individually on conservation tasks involving number, substance, length, distance, area, weight and volume. After pre-testing, 51 children, who failed with two or more of these attributes, were allotted to three matched groups. Each child was matched by a child in each of the other two groups according to CA, IQ and level of understanding of conservation. Age differences were less than 15 months and IQ differences less than 16 points. Each group

contained 17 children, nine who had failed on area and volume tasks, three who had failed on area, volume and weight, one who had failed on area, volume, weight and length, two who had failed on area, volume, weight, length and substance, and two who had failed on area, volume, weight, length, substance and number. One group was then given one scheme of instruction while a second group was given another instruction scheme and the third group, the control, was seen by the experimenter for practice in reading.

The two instructed groups were post-tested one week, and again two months, after instruction. The control group was given the pre-test again at the time when the instructed groups received their second post-test.

Throughout the entire investigation each child was treated individually. Also every effort was made to ensure that a child understood the words being used by the investigator and the particular attribute being considered; similarly every effort was made to avoid words or gestures which the child might interpret as a cue to a 'correct' answer. The 34 children who were given instruction were aged 10-16 years, IQs 50-77, and 22 were boys.

(i) *Pre-testing.*

The situations and questions used in pre-testing were, with some modifications, like those used by Piaget; see Piaget (1952, Chapters 1 to 4), Piaget, Inhelder and Szeminska (1960, Chapters 3 to 5, 11 and 14) and Piaget and Inhelder (1940, Chapters 1 and 2). In essence, each problem began by presenting two sets of material, A and B, which the child was able to judge equal with regard to the particular attribute in question; then one set, B, was transformed in full view to give B¹ and the child asked to compare A and B¹ with regard to the same attribute. Inequality situations were included for each attribute in order to clarify the child's understanding of terms and expose any tendency to agree to sameness regardless of the actual situation. Each child was seen alone for about 30 minutes in a quiet room of the school. After a child made a judgment, the experimenter asked him why he thought what he did. The child's performance was recorded on a standard form and, as far as possible, his comments were written down verbatim.

The specific problems were, briefly, as follows. *Number*: 6 and then 12 beads were transferred into different-shaped glass containers; then 10 flowers were taken out of their jars and bunched nearer together and spread farther apart than the jars. *Substance*: glass containers, different from those used above, were used for liquid transformations; then plasticine transformations were made. *Length*: sticks were placed between Mueller-Lyer arrowheads (such as Smedslund, 1964, used) as well as 'staggered'; then strips of paper were cut and positioned in different ways. *Distance*: Piaget's 50 cm. spacing of objects was used and, after dividers were put between, the experimenter questioned the child, indicating a straight path between object and object and signifying the objects by name. *Area*: a small number of houses on each of two fields was presented and one arrangement transformed and then the same was done with larger numbers of houses; then, Piaget's rearranged shapes were incorporated into the problem situation of potato plots on fields and questions of complementary as well as interior area were asked. *Weight*: plasticine shapes were transformed; then cotton wool shapes were transformed. *Volume*: Piaget's interior and displacement volume situations were presented; then a displacement situation unlike his was introduced in which there was an actual transformation of material—wooden and metal unit-cubes were used in these situations.

With these various problems children showed, as might be expected, considerable individuality. Nevertheless, when the problems were considered by attribute and each child classified as either conserving or not with that attribute, a striking developmental sequence emerged. The criteria for such classification were stringent. A child was classed as conserving a particular attribute if, and only if, he recognised conservation in *every one* of the problems concerned with that attribute *and also* supported his judgments with adequately indicated reasons. These adequate reasons were of three types: (a) *Reversibility*, e.g., 'it could go back the same' or 'the other could be put the same.' This type of reason was in fact, the most commonly given. (b) *Identity*, e.g., 'it's still the same (material)' or 'you didn't take any away or add any.' This type was almost as commonly given as reversibility and, often, both types were given together. (c) *Compensation*, e.g., 'one is more (one way) but the other is more (another way).' This type of reason was rarely given.

When these criteria were used to classify each child as conserving (+) or not conserving (—) on each attribute, the overall outcome was as shown in Table 1, where 10 distinct patterns in the children's recognition of conservation are displayed. (Distance problems were excluded from the table because, while all children recognised the continuing equality, there was no evidence that anything more than perceptual judgment was necessarily involved). Table 1 bears on the first question mentioned in the Introduction and gives clear evidence for a developmental sequence which is perhaps most economically summarised by saying that children appreciate conservation of number, before substance and length, before weight, before volume and area.

TABLE 1

SUMMARY OF RESULTS SHOWING DEVELOPMENTAL SEQUENCE RELATED TO ATTRIBUTE.

	Number	Sub'nce	Length	Weight	Volume	Area	N
Pattern a	—(6)	—(2)	—	—	—	—	15
Pattern b	+	—(5)	—	—	—	—	18
Pattern c	+	+	—	—	—	—	5
Pattern d	+	—(2)	+	—	—	—	3
Pattern e	+	+	+	—	—(1)	—	16
Pattern f	+	+	—	+	—	—	1
Pattern g	+	+	+	+	—(7)	—	37
Pattern h	+	+	+	+	+	—(9)	11
Pattern i	+	+	+	+	—(2)	+	2
Pattern j	+	+	+	+	+	+	7
Number con- serving attribute	100	79	76	58	18	9	115

Also shown in Table 1 is the number (in parentheses) of children who, with regard to a particular attribute, recognised and gave reasons for conservation in some but not all material situations for that attribute. As the table shows, this type of performance tends to occur in accordance with the overall developmental sequence. For example, in pattern g, 37 children conserved completely on all attributes except volume and area, but seven recognised conservation in some volume situations, even though not in all the volume situations, and no child did this with area.

The influence of specific task variables is not easy to summarise. Overall, and with regard to any particular attribute, differences in the material situations presented influenced some children's recognition of conservation, and differences in the transformations made influenced recognition of continuing equality. (Where children are said to 'recognise conservation' they gave reasons for their judgments; where they are said to 'recognise continuing equality' they did *not*.) In more detail, the effects were as follows:

Volume: six children recognised conservation in the interior and second displacement situations but not in the Piaget-type displacement situation; two children recognised conservation in both displacement situations but not in the interior situation; and two other children recognised conservation in the interior but not in either displacement situation. There was no evidence of a necessary interior-before-displacement volume conservation sequence.

Area: nine children recognised conservation with the plots-on-fields but not with the houses-on-fields; no child conserved with the houses who did not also conserve with the plots. 55 children recognised equality of area for transformations of 2 or 2 and 4 but not 12 and 20 houses on fields; 29 children recognised equality of area for 2 but not 4 piece transformations of plots, and of these 29 children, 17 did not recognise equality of the fields, as opposed to plots, area for *either* the 2 or the 4 piece transformations.

Substance: eight children conserved with liquids but not with solids while only one child conserved for solid but not liquid substance.

Number: five children conserved with flowers and jars but not with beads in beakers; one child did the reverse.

Length: nine children recognised equality in the staggered sticks transformation but not in the Mueller-Lyer and paper strips transformations; four children recognised equality in the staggered sticks and Mueller-Lyer transformations but not in the paper strips transformations.

In the case of *weight* the different materials and transformations did not give rise, in this investigation, to any differences in recognition of conservation or of continuing equality.

In the *distance* situation, all children recognised the equality though dividers were put between the objects. They understood the distance in question and considered object to object, not object to divider, going through, not over or around, the divider; several children, for example, said it was the "same far when you keep going through." Perceptual judgments may be all that were necessary; many children said "it looks as far still" or "it's still a way." Often children just emphatically stated that it was the "same going" or pointed and said that the objects were "there and there." Some children explained that the objects "haven't moved" or "haven't been put any nearer." A few children suggested measuring to show the distance was the same. The children's explanations were unlike their explanations of conservation in the other attribute situations; the usual identity, reversibility, compensation arguments would be less appropriate in the distance situation.

(ii) *Teaching.*

As explained above, 51 children took part in this phase of the inquiry and they were divided into three groups, E1, E2, and C, with 17 in each. The children in these groups had failed to recognise conservation for two or more attributes; they were non-conservers in *all* material situations for those attributes. Group

E1 was given instruction according to Scheme 1: this scheme was designed to develop a broadly general understanding of conservation of quantity and it deployed various attribute situations while avoiding detailed discussion of the particular attributes. Group E2 was instructed according to Scheme 2: this aimed explicitly at only conservation of area and it deployed only Piaget-type area situations. Group C was given no instruction about conservation: these children were seen by the experimenter for the same length of time as E1 and E2 children and, during that time, they read to the experimenter from their classroom books and answered questions on their reading.

Both Schemes 1 and 2 deployed five basic types of explanation for conservation and four types of experience. The types of explanation were: it is the same (material) all the time; nothing has been taken away or added; it looks different but really it is the same (material); one is more (this way) but the other is more (that way); and you can put it back as it was before. The types of experience were: verbalisation of reasons for conservation, in conjunction with; observation of materials and transformations; and manipulation of reversible transformations; and the use of an external criterion. This variety of explanations and experiences was deliberate in order to develop a fuller understanding and to accommodate individual differences. The writer's previous investigations indicated that successful instruction enabled the child to build up a many-sided case for conservation and that different children were more responsive to certain aspects of this case than to others. In brief, the aim was to help all children to appreciate the grounds for conservation judgments, to look for evidence of conservation or non-conservation, to develop relevant verbal arguments and to give conservation judgments not merely for one particular reason. Every child was instructed individually for one session of approximately 20 minutes. The teaching procedure was flexibly adapted to the individual child, but kept within the standard limits for each scheme and included the set explanations and experiences.

In Scheme 1, six situations were used. These were taken from the pre-test tasks and (excluding the distance task) involved one material situation from each pre-test pair related to each of the six attributes. Situations were chosen so as to give, overall, the greatest diversity of materials and, with each situation, two or three transformations were used. For number, children matched and counted flowers and jars; 10 flowers were bunched and then five spread. For substance, children did not use any form of measurement but merely manipulated reversibility, as was done in every attribute situation; one portion of orange drink was poured into a petri dish and then one portion into four beakers. For length, children marked the sticks off on a common longer stick when 10 cm. sticks were staggered and when 20 cm. sticks were put into Mueller-Lyer arrowheads. For area, children did not use any external criterion but did manipulate reversibility of the plot and field transformations. For weight, they again did not use a measure but manipulated reversibility of plasticine pancake and 10-piece transformations. Finally, for volume, they marked off the water level displacements in a common container for $6 \times 6 \times 1$ and $4 \times 3 \times 3$ -in-4-parts transformations of metal block constructions.

In Scheme 2, the two area situations from the pre-test were used, i.e., houses-on-fields and plots-on-fields. With each situation three transformations were made. These children did what the Scheme 1 children did for area but, in addition, they used an external criterion. They covered the potato plots and the fields with transparent perspex grids and counted the number of rectangles covering the different transformations.

(iii) *Post-testing.*

Groups E1 and E2 were given a standard post-test one week and then again two months after instruction. Each child was tested alone for about 25 minutes. The post-test included 13 of the pre-test situations plus seven new material situations and six conservation of *inequality* situations. Seven of the 13 pre-test situations were those in which conservation had been taught to the E1 group, while the other six were familiar to them only from the pre-testing; only two of the pre-test situations had been used in teaching the E2 group. In addition to the situations from the pre-test, new material situations were introduced for the types of situations in which conservation had been taught: for example, plasticine balls of equal volume but different weight were introduced in the displacement volume situations. Likewise, conservation of *inequality* situations were included instead of the straight *inequality* situations of the pre-test which had not involved conservation. One transformation was made in each post-test situation. No distance situation was included.

Results for the 17 E1 and the 17 E2 children were strikingly similar. In each group 15 children recognised conservation in *every* situation of the post-test, both one week after and two months after instruction. So, for 30 of the 34 children, either scheme was equally effective in developing a generalised and durable understanding of conservation. Interestingly, the remaining four children, who did not learn from either scheme, were the four who, in the pre-test, had shown *no* understanding of conservation, i.e., who failed to conserve even with number. On the post-test, these four children attended to the different problem situations; in making perceptual choices, they understood and used appropriately terms such as 'same' and 'more'; they did not choose exclusively either the original or the transformed portions; they gave coherent and not totally irrelevant explanations for their judgments which were more than just random guesses; but they made no conservation judgments and remained total non-conservers throughout both post-tests. With these children the inefficacy of the schemes was clearly related to pre-test performance. But otherwise, children with different levels of initial understanding seemed to learn equally well from the schemes.

The 30 children who profited from instruction all gave clear reasons for their judgments. The commonest reason, by far, was the 'nothing has been added or taken away' form of identity reason. The next most common reason was reversibility. Compensatory relationships and the identity of the material were rarely mentioned as reasons for conservation. The reasons individual children gave on the first and second post-tests were similar.

More than a verbal formula or rote response was learned. The children's explanations were expressed in varied and often very full terms appropriate to the particular situations and transformations. In addition to the identity, reversibility and compensation types of reasons, many children also suggested an external criterion for evidence of conservation. There were differences both between different children's explanations and within any one child's explanations. For example, one boy gave the following reasons for his conservation judgments:

You haven't took none away and you haven't added none. You can put them back in the same line. If you put a bead in you'd have one over. It's higher but the other's rounder. You can tip it back to come the same level. It's the same plasticine. You can make the other the same way. It was the same at the start. It'll bend back the same again. Put them all together and measure it the same. It puts back bigger still. It's the same

metal squares and the same heaviness. It was the same block at first and you haven't moved none off. You must have took some away from one and not from the other before.

Another child gave the following reasons :

There are 10 (or 12) in each like before. The taller thinner one still has six and less. One's fatter but the other's taller and the orange tips back the same. It's the same heavier still. Put it together and it measures the same. It still measures smaller. It puts back the same—see (demonstrating reversibility). It's longer but the other's fatter. It's taller—the other's wider. You can make it the same by taking houses off the other field. You'll see it's the same if you weigh them on a scale. It closes back the same. You can put both in and measure each one the same. If you put any on the water would go up. You haven't took any water away. You haven't added or taken away any bricks.

On inspecting these reasons it was evident that no mere rote formula was involved.

When the 17 control group children were given the repeat pre-test, all 17 still gave non-conservation judgments in every situation where they had done so in the original pre-test. Their understanding of conservation had not advanced at all in the intervening two months.

DISCUSSION

The pre-test results showed a clear developmental sequence in the appreciation of conservation of a range of attributes. Number came first, then substance and length, then weight, then volume and area. This particular sequence differs somewhat from that reported by Piaget (see Piaget, Inhelder and Szeminska, 1960; Piaget, 1952; Piaget and Inhelder, 1940) and again from that reported by Goldschmid (1967). The sequence agrees with those reported by Piaget and Goldschmid with regard to substance-weight-volume, but differs with regard to the other attributes and the order in which their conservation is recognised. These discrepancies in sequence are presumably attributable to variations in the specifics of the problems used by different investigators, and in the exact criteria used to distinguish conservation from non-conservation.

Returning to the pre-test results, it is still important to ask why the attribute sequence turned out as it did. This question cannot be answered fully but three points can be made. Firstly, the difficulty of any problem is determined by several factors taken together: these involve not only the material situation and the nature of the transformations but also the wording of the questions relating to the different attributes. Secondly, the fact that conservation of one attribute is recognised before that of another attribute does not necessarily mean that the former is integral to the latter, e.g., number conservation is not necessarily involved functionally in length conservation (indeed, the two can be in opposition in the same situation), nor is conservation of number or length necessarily involved functionally in conservation of weight. Thirdly, problem difficulty would seem to be a function of the complexity of the selection and synthesis required. For example, volume and area problems are the most difficult and these, as contrasted to length problems, require consideration of more dimensions, are less directly open to simple inspection, less easily measured, and more abstract. Familiarity may serve to reduce complexity as when counting is available as a simple and much practised procedure for use in verifying number conservation.

The pre-test results also revealed the influence of specific task variables which, again, raises the question of what determines the difficulty of a problem. With volume, conservation is more easily recognised in some situations than others but, as the writer found previously (Lister, 1970), there was no evidence of a necessary interior-before-displacement-volume sequence such as reported by Piaget, Inhelder and Szeminska (1960). With area problems, children found it harder to recognise conservation with the houses-on-fields situation than with the plots-on-fields. Goldschmid (1967) reports similarly but Piaget, Inhelder and Szeminska (1960) found conservation of *fields* area with the plots-on-fields situation to be harder than with the houses-on-fields. In the present investigation, there was no evidence that conservation of complementary (i.e., fields) area is understood later than conservation of interior (i.e., plots) area, though Piaget, Inhelder and Szeminska (1960) found this to be the case; for the plots-on-fields transformations only differences in perceptual recognition of continuing equality were found.

The two schemes of instruction were found, for 30 of the 34 children, to be equally effective in developing a generalised and durable understanding of conservation. It might be asked whether this instruction helped children to apply a partial understanding of conservation to new attribute situations or to develop some qualitatively novel understanding, that is, whether instruction 'activated existing structures' or 'created new structures.' This question was not pursued, and for two reasons. First, the distinction embodied in this question is, at the least, operationally unclear. Secondly, even if the question should turn out to be of an answerable kind, the answer would seem to have slight relevance to practical problems of instruction.

It was found that initial level of understanding did not affect responsiveness to instruction—with the notable exception of those four children who initially showed *no* conservation in *any* of the pre-test problems. These children did not benefit from either scheme of instruction. Whether they could benefit from another instruction scheme is a question which was answered by further investigation. They were given fuller and more prolonged instruction involving simple comparison, one-to-one correspondence, creation of equality, addition/subtraction, and identity conservation problems as well as equivalence conservation problems. As a result, three of these four children fully caught up with the others in their understanding of conservation of quantity.

Finally, the control group children were, as controls, exemplary in that their understanding of conservation remained static during the two months which separated testing. This lack of 'spontaneous' development is a matter of practical educational concern because it indicates the extent to which ESN children depend on explicit teaching for their mental advancement (see Hunter and Lister, 1970).

Detailed descriptions of the pre-and post-test situations and questions are available from the writer.

ACKNOWLEDGMENTS—The writer is again grateful to Professor I. M. L. Hunter for valuable advice throughout the investigation and for detailed suggestions in the preparation of this paper. The writer also wishes to thank Mr. E. E. Gaunt of the Aynsley School, Stoke-on-Trent, for making available the children and the space for the experiment to be carried out.

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(Manuscript received 29th April 1971)

PERSONALITY FACTORS AND SCHOLASTIC ATTAINMENT

By C. D. ELLIOTT

(*Department of Education, University of Manchester*)*

SUMMARY. Previously reported correlations between extraversion-introversion and scholastic attainment were examined and a consistently changing relationship was noted depending on the mean attainment level of the subjects. The relationship between reading attainment, intelligence, extraversion and neuroticism was then examined for groups of junior school children whose CA, MA and RA were relatively constant. It was concluded that there is a high correlation between extraversion and RA but a negligible one between extraversion and IQ when MA and RA respectively are held relatively constant. Neuroticism was negatively correlated with scholastic attainment, confirming other findings on school children. Finally, an explanation of the effects of personality upon scholastic attainment was suggested.

INTRODUCTION

A number of studies during the last decade have examined the relationship between extraversion and scholastic attainment. In general, the results suggest that there is a positive correlation during the early school years and a negative correlation during the later school years and at university.

Although some studies do not report correlation coefficients for this relationship due to other statistical techniques being employed, or because no single measure of extraversion was incorporated in the battery of measurements, nevertheless a sufficient number of correlations are available to illustrate the relationship which appears to hold. Table 1 summarises these findings.

TABLE 1

CORRELATIONS BETWEEN EXTRAVERSION AND SCHOLASTIC ATTAINMENT AT VARIOUS ESTIMATED MEAN LEVELS OF ATTAINMENT.

Author	Mean CA of Sample	Estimated Mean Attainment Age of Sample	r
Kline (1966)	University students	18.0	—·55
Entwistle and Welsh (1969)	14.0	16.5	—·03
Butcher (1969)	13.5	15.5	—·13
Entwistle and Welsh (1969)	14.0	14.0	·02
Child (1964)	13.0	13.0	—·18
Entwistle and Cunningham (1968)	13.0	13.0	·02
Rushton (1966)	10.5	12.1	·15
Entwistle and Cunningham (1968)	12.0	12.0	·04
Entwistle and Welsh (1969)	14.0	11.5	·19
Eysenck and Cookson (1969)	11.25	11.25	·19
Savage (1966)	7.9	7.9	·19

* Formerly at Hester Adrian Research Centre, University of Manchester.

A number of the figures in the table are best estimates in the absence of exact figures. In order to estimate the mean attainment ages of the samples it was frequently necessary to take the mean attainment quotient, multiply by the mean chronological age and divide by 100, according to the practice first introduced by Terman (1916) for the calculation of IQs. Attainment quotients were estimated at 115 in two cases (Rushton, 1966 ; Butcher, 1969) where the ability level of the groups was stated to be above average. In the case of the sample of university students (Kline, 1966) an attainment age of 18 was adopted for the purpose of the present study, although it is realised that the concept of attainment age at this level of attainment is questionable. It should further be pointed out that the quoted correlations are for combined groups of boys and girls. The correlations given by Entwistle and Welsh (1969) were for boys and girls separately. The best estimate of their correlations for boys and girls combined has been made by taking the mid-point between the two groups. It was found necessary to present the correlations in this way, as a number of studies did not present the results of each sex separately. There is evidence, however, that junior girls are superior in English attainments (e.g., Eysenck and Cookson, 1969), and that it is likely that there are differences between the sexes in level of extraversion (S. B. G. Eysenck, 1965 ; Elliott, 1971). Such differences are likely to give rise to different correlations between extraversion and attainment for each sex at a given age level (Entwistle and Cunningham, 1968 ; Entwistle and Welsh, 1969 ; Eysenck and Cookson, 1969).

The figures given in Table 1 indicate a linear relationship : the lower the average level of attainment in a group of children the higher is the correlation between attainment and extraversion. The reasons for this relationship have been the cause of speculation by a number of authors. Eysenck and Cookson (1969) suggest that introverts are 'late developers,' and suggest that some of the differences in scholastic performance shown by differing personality groups may be a reflection of differing responses to social motivation. Entwistle and Welsh (1969), Entwistle and Cunningham (1968), and Finlayson (1970) also seem to favour an explanation in terms of social behaviour patterns.

The other major personality factor of neuroticism also appears to influence scholastic attainment. In general, results indicate that high emotionality has an adverse effect upon the performance of school children (e.g., Butcher *et al.*, 1963 ; Butcher, 1969 ; Entwistle and Cunningham, 1968 ; Entwistle and Welsh, 1969 ; Eysenck and Cookson, 1969 ; Leith and Davis, 1971 ; Savage, 1966). Correlation coefficients characteristically range from $\cdot 1$ to just over $\cdot 2$. Usually this relationship has been found to be linear, although Eysenck and Cookson (1969) and Finlayson (1970) have suggested the possibility of non-linearity together with an interaction between neuroticism and extraversion.

The variation in results in the studies mentioned above seems to indicate that further investigation is called for into the influence of personality factors upon scholastic attainment. In particular, the changing effect of extraversion with age seems to require further explanation in terms of the learning characteristics of extraverts and introverts.

One further point requires mention. Eysenck's theory of personality postulates that intelligence, extraversion and neuroticism are orthogonal. In a number of the studies previously cited, however, there are significant correlations between IQ, extraversion and neuroticism. This is presumably because verbal reasoning and scholastic attainment tests are themselves highly correlated and tend to measure similar abilities. No relationship should be found between intelligence and personality factors in a sample of equal scholastic attainment.

Similarly, if there is a meaningful relationship between scholastic attainment and personality this should be observable in a sample whose mental age is constant.

To hold the relevant variables constant in one sample through the use of partial correlation techniques may not be completely desirable. The problems of interpreting partial correlations with psychological test data are discussed in a number of statistics textbooks (e.g., Garrett, 1958; Guilford, 1956; Lewis, 1967). In view of these problems, the investigation reported in this paper exerts experimental, rather than statistical, control over the relevant variables of chronological age, mental age and reading age.

The purpose of this paper is to make further investigation of the relationships between reading attainment, intelligence, extraversion and neuroticism in groups of junior school children whose chronological, mental and reading ages were held relatively constant, and to attempt some explanation of the reasons for such relationships.

THE PRESENT STUDY

Subjects.

The subjects were drawn from four primary schools in small towns. Three groups of subjects were selected. There was some degree of overlap between the groups, some subjects being in more than one group. The groups were selected as follows:

Chronological Age Restricted (N=111). This group was comprised of all children in the schools whose CA was 8 years 6 months to 8 years 11 months, inclusive.

Mental Age Restricted (N=110). This group was comprised of all those children in the schools who obtained a raw score on the Moray House Picture Intelligence Test equivalent to an IQ of 100 for children whose chronological age is 8 years 6 months to 8 years 11 months, inclusive.

Reading Age Restricted (N=101). This group was comprised of all children whose reading age on the Schonell Graded Word Reading Test was 8.5 to 8.9 years, inclusive.

Tests employed.

Three tests were given to all subjects by the schools during one week:

- (a) Schonell Graded Word Reading Test (Schonell and Schonell, 1960).
- (b) Moray House Picture Intelligence Test 1 (Mellone, 1958).
- (c) Junior Eysenck Personality Inventory (S. B. G. Eysenck, 1965).

Analysis.

The six relevant variables in this study are chronological age (CA), reading age (RA), IQ and scores on the extraversion, neuroticism and lie scales of the JEPI. With one of the first three variables restricted in each of the experimental groups, the remaining five were correlated.

Each of the three groups was also subjected to a zone analysis (Furneaux, 1962; Eysenck, 1966). A median split was made in the distribution of extraversion and neuroticism scores for each group, yielding four sub-groups. The numbers in each sub-group were equalised to 25 by random selection. An analysis of variance was applied to the reading and IQ scores in the group with restricted CA, to the reading scores in the restricted MA group and to the IQ scores in the restricted RA group.

RESULTS

The results for the three samples are given below. In analysing the results, it was found that the mean reading age of the girls was 0.51 years higher than that of the boys. This difference was non-significant ($t=1.51$, $P>.05$) as were also the differences between the means and variances of each sex on all other variables. The scores of the sexes were, therefore, combined in the following analysis.

Chronological Age Restricted.

The means of each of the personality groups on the variables of reading age, and IQ, extraversion and neuroticism are given in Table 2.

TABLE 2

MEAN SCORES FOR GROUP WITH CA RESTRICTED.

Degree of Neuroticism	RA		IQ		Extraversion		Neuroticism	
	Extra.	Intro.	Extra.	Intro.	Extra.	Intro.	Extra.	Intro.
High	8.26	6.88	104.44	91.76	18.20	10.88	17.96	18.76
Low	10.85	8.42	113.04	99.28	19.16	13.80	12.04	13.96

These results suggest that the sample was reasonably representative of the population at this age level. The IQ and extraversion means and standard deviations were close to the test norms, and the RA of the group was very close to their mean CA. The widest deviation from the published norms was in the mean neuroticism score, on which the samples were almost one standard deviation above the norms.

Intercorrelations between the variables are given in Table 3. There was an expected significant correlation between RA and IQ. There were significant correlations between RA and extraversion ($P<.01$), and between RA and neuroticism ($P<.01$). Neuroticism and extraversion also correlated significantly with IQ ($P<.01$), and with each other ($P<.01$). This latter correlation agrees with the results of a number of other studies (Eysenck and Cookson, 1969; Finlayson, 1970).

TABLE 3

INTERCORRELATIONS BETWEEN RELEVANT VARIABLES FOR GROUP WITH CA RESTRICTED.

	IQ	E	N
RA	.57	.60	— .59
IQ		.43	— .29
E			— .39

A 2×2 analysis of variance was carried out on the RA and IQ scores of this sample, with two E groups and two N groups. On the reading test, both E and N produced highly significant effects ($P < .001$) and there was a significant interaction effect ($P = .024$). The mean scores given in Table 2 indicate that neuroticism had a somewhat greater adverse effect upon reading test performance among extraverts than among introverts. For IQ both E ($P < .001$) and N ($P = .002$) were highly significant, and there was no significant interaction effect.

Mental Age Restricted.

The means of each of the personality groups on the four unrestricted variables are given in Table 4.

TABLE 4
MEAN SCORES FOR GROUP WITH MA RESTRICTED.

Degree of Neuroticism	CA		RA		Extraversion		Neuroticism	
	Extra.	Intro.	Extra.	Intro.	Extra.	Intro.	Extra.	Intro.
High	8.75	8.84	9.15	6.83	18.04	10.36	15.68	17.80
Low	8.44	8.35	9.62	7.58	18.36	12.64	11.04	11.36

Intercorrelations between the variables are given in Table 5.

TABLE 5
INTERCORRELATIONS BETWEEN RELEVANT VARIABLES FOR GROUP WITH MA RESTRICTED.

	CA	E	N
RA	-.11	.73	-.15
CA		-.09	.27
E			-.34

The correlation between RA and E was highly significant ($P < .01$), but that between RA and N was non-significant.

The negligible correlation between CA and RA may at first sight seem surprising. It is evident that in the population as a whole there is a rise in scholastic attainment with age. This sample, however, has had much of the variance due to mental age differences removed. The result may indicate that a rise in attainment is commensurate with a rise in *mental age*, with the length of time a child has been taught having little influence on his attainments, at least at this age level. Further research would, however, be necessary in order to throw more light on this problem.

Once again, E and N showed a significant negative correlation ($P < .01$).

A 2×2 analysis of variance was carried out on the RA scores of the sample. Both E and N produced highly significant effects ($P < .001$ and $P = .01$, respectively) and there was no significant interaction.

Reading Age Restricted.

The means of each of the personality groups on the four unrestricted variables are given in Table 6.

TABLE 6
MEAN SCORES FOR GROUP WITH RA RESTRICTED.

Degree of Neuroticism	CA		IQ		Extraversion		Neuroticism	
	Extra.	Intro.	Extra.	Intro.	Extra.	Intro.	Extra.	Intro.
High	9.12	8.71	93.96	101.12	18.76	13.72	18.20	17.00
Low	9.26	8.40	101.44	107.12	18.84	13.92	10.48	13.56

Intercorrelations between the variables are given in Table 7.

TABLE 7
INTERCORRELATIONS BETWEEN RELEVANT VARIABLES FOR GROUP WITH RA RESTRICTED.

	CA	E	N
IQ	—·54	—·30	—·29
CA		·31	·00
E			—·10

Neuroticism was negatively correlated with IQ ($P < .01$).

The negative correlation between CA and IQ is expected—older children with a reading age of $8\frac{1}{2}$ will tend to have lower IQs than younger children with similar attainments. The influence of CA is also shown in the significant negative correlation between IQ and E ($P < .01$). With CA partialled out the correlation between IQ and E was reduced to a non-significant figure ($r = -.17$, $P > .05$).

A 2×2 analysis of variance confirmed the significance of the main effects of both E and N upon IQ ($P < .01$). There was no significant interaction effect.

It appears from these results that the significant influence of E upon IQ disappears when attainment and CA are held constant.

DISCUSSION

Some conclusions may perhaps be drawn from this experiment, although these must be tentative in view of the relatively small samples of children:

(1) At a given CA, when both IQ and RA are allowed to vary, they both correlate significantly with extraversion. This confirms many previous findings using samples of young children.

(2) The correlation between RA and extraversion is highly significant when the mental age of the sample is held relatively constant.

(3) There is no significant correlation between IQ and extraversion when the attainment level and CA of the sample are held relatively constant.

(4) The correlation between IQ and extraversion when both mental age and attainment are allowed to vary is due to the correlation of IQ with attainment. The findings of this experiment are in accord with Eysenck's general theory that extraversion and intelligence are independent.

(5) Neuroticism is negatively correlated with both IQ and RA in young children.

If the correlation between extraversion and IQ is merely the result of the correlation of both these variables with reading ability, the question which now arises is how to explain the relationship between extraversion and reading or general scholastic attainment. It has been previously noted in this paper that this relationship varies systematically for different levels of attainment.

Eysenck (1955, 1957) has suggested that the personality dimension of extraversion-introversion is related to individual differences in level of cortical excitation and inhibition. EEG studies have provided evidence that there is a lower level of cortical arousal in extraverts (Gale, Coles and Blaydon, 1969). A large number of predictions concerning the theory in general have been verified (Eysenck, 1967): in particular, introverts appear to develop conditioned responses more easily than extraverts and develop less reactive inhibition. It would also seem that extraversion can be reliably measured in children aged at least 5 years and upwards (Elliott, 1971).

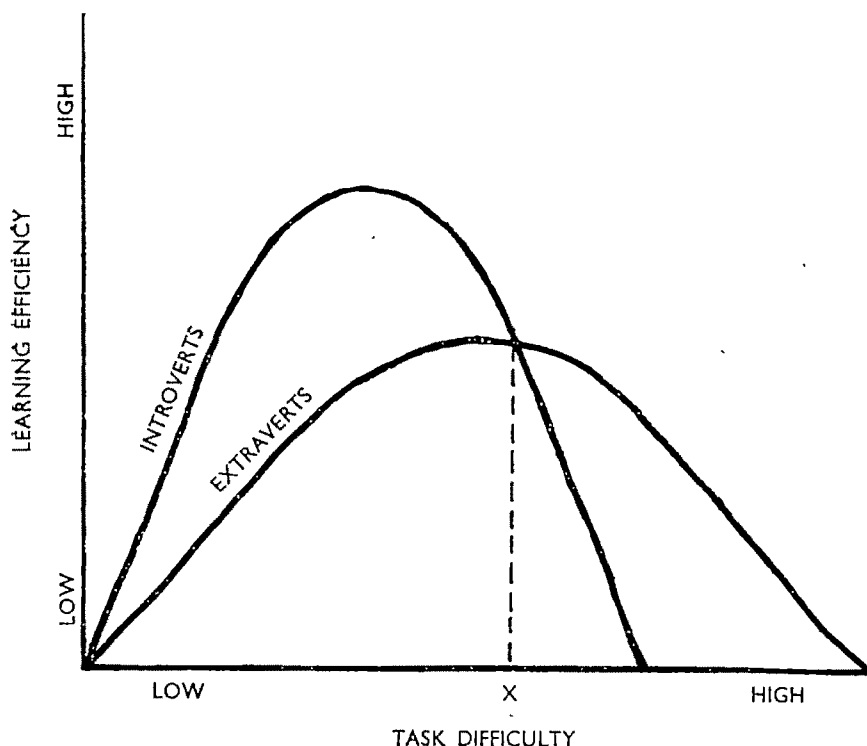
The performance of introverts and extraverts in a learning situation can be expected to differ according to whether or not the level of task difficulty is above or below an optimal level. The difficulty of a task may be related to the habit strength of the correct response in comparison with that of incorrect competing responses. Where correct performance of the task depends upon a relatively weak habit, the task is relatively difficult. In the case of a correct response which is based on a relatively strong habit, the task is relatively easy. Where the level of task difficulty is optimal or below, introverts would be expected to show better learning performance than extraverts, due to having a higher level of arousal, a lower level of reactive inhibition, and quicker dissipation of any reactive inhibition which develops. An increase in task difficulty above an optimal level, however, may be expected to lead to *reduced* efficiency in the performance of introverts. Their higher level of general arousal would lead to a heightened tendency to make competing responses arising from old habits of response (Taylor, 1956; Spence, 1956).

A further important aspect of the behaviour of introverts is that they are particularly susceptible to punishment, or the omission of anticipated reward, whose effects are functionally and physiologically similar (Gray, 1970). Under such circumstances, they would be expected to develop aversive conditioned responses to a greater extent than extraverts. High levels of task-difficulty may be expected to evoke a 'conditioned avoidance drive' (CAD) which has been learned after having previously been produced in failure situations (Jones, 1960). Note here that failure, or non-receipt of expected reward, is just as likely as punishment to evoke such a response (Gray, *op. cit.*), which would adversely affect introverts' learning efficiency. The relationship between

learning efficiency and task difficulty for extraverts and introverts can be seen in Figure 1.

FIGURE 1

LEARNING EFFICIENCY IN INTROVERTS AND EXTRAVERTS RELATED TO TASK DIFFICULTY.



Where the level of task difficulty is higher than X, extraverts show greater learning efficiency, the converse being true for levels lower than X.

In applying the above hypothesis to the study of the relationship between extraversion and scholastic attainment, it is suggested that attainment age is a measure of task difficulty, even though not necessarily synonymous with it. Task difficulty in school work can be defined as a function of the proportion of the total amount of information which it is possible to acquire to the amount of information actually acquired by an individual. This will no doubt be modified by a number of variables related to teaching skill and methods. These, however, will probably remain fairly constant through the fairly standard methods of teacher training and schemes of work presented to the children. Thus, in a given subject, a small amount of acquired information (i.e., a low attainment age), would indicate that the task difficulty level is high.

Referring once again to Table 1, it can be estimated that the level of general scholastic attainment where it is predicted that neither extraverts nor introverts show great learning efficiency is an attainment age of approximately 12 years. In terms of general scholastic attainment, therefore, we can relate the point X in Figure 1 to an attainment age of about 12 years. For levels of difficulty above this point (i.e., general attainment ages below 12 years) extraverts show

greater learning efficiency, while for levels of difficulty below this point (i.e., general attainment ages above 12 years) introverts show greater learning efficiency.

It is appropriate at this point to consider the influence of neuroticism, or emotionality, upon scholastic performance. Eysenck (1967) suggests that emotion acts as a drive, and is a function of greater emotional arousability in some people, as compared with others. If this is so, one would expect that there would be an interaction between extraversion and neuroticism in their effects upon scholastic attainment, in that high drive (i.e., high arousal, or high N) would adversely affect extraverts at low attainment levels, but that it would improve their performance at high attainment levels. As will be seen in the introduction the evidence does not generally support this hypothesis, emotionality having negative correlations with scholastic attainment over a wide CA and ability range. Gray (1970) has recently suggested an alternative view of emotionality which may be helpful in explaining these results. He suggests that emotionality should be treated as degree of sensitivity to reinforcement, i.e., to both reward (including the omission of anticipated punishment) and to punishment (including the omission of anticipated reward). Such heightened sensitivity to reinforcing situations could result in a previously learned CAD being evoked more frequently by both extraverts and introverts, producing an overall adverse effect upon performance. In university students, who constitute a highly selected group of successful attainers, the number of rewards for scholastic attainment is probably higher than in the population as a whole. In such a group, the positive correlation between N and attainment may reflect the increased sensitivity of high N scorers to reward.

The theory expressed in this paper helps to explain the differences between the sexes in the correlation between extraversion and attainments which Entwistle and Cunningham (1969) have reported. There appear to be significant sex differences in extraversion, boys being more extraverted than girls (S. B. G. Eysenck, 1965; Elliott, 1971). The samples with which Entwistle and his co-authors were working were comprised of children whose mean attainment ages were near the level where no overall correlation with extraversion could be expected. At such a level, one would expect that girls, being more introverted, are more likely to have a CAD evoked by the difficulty of the work than boys. Such a group would be expected to show a positive correlation between attainment and extraversion. In the boys, who are more extraverted, there is less chance of a CAD being evoked, resulting in a negative correlation between extraversion and attainment. In other words, at a mean attainment age of 13 or 14 years, introverted boys tend to have higher attainments than extraverted boys, whereas it is the extraverted girls who tend to have higher attainments than introverted girls.

Differences in the correlations between extraversion and scholastic attainment for high and low ability groups at this chronological age level can also be explained in terms of the difference in attainment levels in the two groups. If much older or much younger groups had been studied (i.e., if the level of task difficulty had been lowered or raised) it would be predicted that the correlations for the two sexes and the two ability groups would all be in the same direction but would differ in magnitude. Eysenck and Cookson (1969) made a similar finding when they examined the ratio of the observed difference between extraverts and introverts on various tests to the standard deviation of the tests. With a younger sample than in Entwistle's studies, they found that this ratio was larger for girls than for boys, although the direction of the differences was the same for both.

The specification of task difficulty level in terms of attainment age in a given subject appears to be a useful method of comparing the learning efficiency of various personality groups at various age levels and for various school subjects. Should the suggestions in this paper be supported by further research, they could have implications for the early teaching of children and their future educational assessment and selection.

ACKNOWLEDGMENTS—The writer is most appreciative of the co-operation given and the time spent in collecting data by the heads and staffs of the schools concerned. He was financially supported by the Social Science Research Council.

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(Manuscript received 29th April, 1971)

VISUAL AND AUDITORY MEMORY IN SPELLING: AN EXPLORATORY STUDY

By J. B. DAY

(Trent Park College of Education, London)

AND K. WEDELL

(School of Education, University of Birmingham)

SUMMARY. Using visual and auditory memory sequencing tests with 140 children aged 8-10, this study aimed to investigate the commonly held assumption that visual and auditory memory are important component functions in children's spelling. From this sample three sub-groups were derived. The first (18 children) consisted of those whose scores were higher on the visual memory than on the auditory memory test by 1 sd or more. The second (22) were those whose scores differed by 1 sd or more in the reverse direction, whilst the third group (21) had test scores which differed by less than .16 sd. The three sub-groups were then given the Schonell Spelling Test of Irregular Words IA and an English Picture Vocabulary Test. No significant differences were found in the groups' mean spelling scores, but there were differences in the proportions of certain error types. The implications of these findings for the role of visual and auditory memory in spelling achievement are discussed.

INTRODUCTION

INTEREST in the component skills of basic educational attainments has been stimulated by the problems presented by children with specific learning difficulties. The establishment of merely the levels of these children's attainment has not of itself proved useful in identifying the nature of their learning problems. Information has therefore been sought on the way in which these children's performance levels have been achieved; in other words, on the patterns of their abilities and disabilities in the component functions. Visual and auditory memory are among the cognitive functions which have been studied in relation to spelling disability (Schonell, 1942; Peters, 1967). Schonell proposed that certain types of children's spelling errors might be the result of inadequacies in visual or auditory memory, whilst Peters found that the methods by which children had been taught to read ('look and say' or 'phonic') was reflected in the spelling errors that they made.

An investigation of the functions of visual and auditory sequential memory in spelling was included in studies by De Hirsch *et al.* (1966) and by Bannatyne and Wichiarajote (1969). De Hirsch found that a rhythm copying test given at kindergarten stage was one measure, though not the most significant, which predicted spelling achievement at second grade. The Bannatyne study, on the other hand, found that performance on the auditory motor sequencing sub-test of the ITPA did not distinguish better from worse third grade spellers and found similarly negative results for the ITPA visual motor sequencing sub-test.

Other workers in this field have inferred competence in visual and auditory memory from children's performance on spelling tasks. Peters (1970) asked children to write down from memory words presented on flash cards. She refers to this task as a measure of visual perception and found children's performance on it to be highly correlated with spelling achievement. De Hirsch *et al.* (1966) found visual word recognition measures at kindergarten stage significantly to predict spelling achievement at second grade.

Since spelling is such a complex task, where different skills may be involved at different levels of performance, the inconsistency of some of the above findings

is hardly surprising. It seemed possible that an investigation from a different point of origin might throw more light on the problem, and indicate possible variation in the interaction of the underlying skills. In the present study children were therefore selected in the first place on the basis of their disparate performance on tests of sequential visual and auditory memory. Their performances on a spelling test were then compared.

METHOD

Sample. All of the children (64 boys, 76 girls) between the ages of 8 and 10 (mean age 9 years 2 months), in three local authority junior schools, were given the tests mentioned below. Children with identified but uncorrected visual or auditory defects were excluded. The schools were selected to include a range of socio-economic and urban-rural differences.

Tests. The Visual-Motor Sequencing Test (VMS) from the experimental version of the Illinois Test of Psycholinguistic Abilities (McCarthy and Kirk, 1961) and the Stambak Reproduction de Structures Rythmiques (RSR) auditory memory test (Stambak, 1964) were administered individually to all of the children in randomised order. The children were tested in their schools.

Selection of Sub-groups. Children's scores on each of the above tests were converted into standard scores and three sub-groups were then selected on the following criteria :

Group VMS : those children whose performance on the VMS test was higher than that on the RSR test by one standard deviation or more ($N=18$)

Group RSR : children whose RSR and VMS scores were correspondingly disparate in the opposite direction ($N=22$).

Group C : children whose scores on both tests differed by 0.16 standard deviation or less (this criterion being chosen since it permitted a third group approximately equal in number to the sizes of the other two groups). There were 21 subjects in this sub-group.

Sub-group Testing. The following tests were administered to the children in the sub-groups, again in their own schools :

- (a) English Picture Vocabulary Test 2 (Brimer and Dunn, 1963).
- (b) Schonell Spelling Test of Irregular Words IA (Schonell, 1932).

Administration of the spelling test was stopped when each child had made 10 errors. These errors were then categorised on the basis of two separate classifications :

Classification 1. This was largely the scheme devised by Livingston (1961), and included the following categories :

- (a) Omissions (other than a failure to double letters)
 - (i) single letter (e.g., supply for supply).
 - (ii) syllables (e.g., gentlemen for gentlemen)
- (b) Insertions of letters (other than erroneous doubling)
 - (i) single letters (e.g., engine for engine)
 - (ii) syllables (e.g., suddaren for sudden)
- (c) Transpositions
 - (i) inversions—adjacent letters (e.g., agian for again)
 - (ii) transposition proper (e.g., uclen for uncle)
- (d) Doubling
 - (i) single letter for double (e.g., coffe for coffee)
 - (ii) double for single letter (e.g., reepoter for reporter)
- (e) Confusions and substitutions
 - (i) single letters (e.g., clinb for climb)
 - (ii) syllables (e.g., becus for because)

- (f) Homophones (e.g., blew for blue, fore for four)
- (g) Perseveration (e.g., unclerc for uncle, latetest for latest)
- (h) Unclassifiable errors, i.e., those errors which could not be placed unequivocally in the categories shown above. Each error could be classified under a maximum of two of the above categories.

Classification 2. Here, spelling errors were classified according to whether they did or did not constitute plausible phonic alternatives (PPAs). These were defined as words which were phonically correct but orthographically incorrect, e.g., 'wunts' for 'once.' Allowances were made for differences in regional dialects, each child's PPA score being based on the mean of three judges' assessments.

RESULTS

Total Sample.

The preponderance of girls over boys in the sample occurred purely by chance, since in each school all of the children between 8 and 10 were tested. The mean raw scores and standard deviations on the VMS and RSR tests were, respectively, 13.53 (sd 3.51) and 13.29 (sd 3.18). The sample's mean scores on both these tests were below the published test norms for the corresponding ages. There are several possible explanations for this. Firstly, it appeared that the sample may have been slightly below average in general ability (see English Picture Vocabulary Test data below). Secondly, the tests were given in isolation and not as part of a battery. Thirdly, the RSR test norms were based on a small and possibly unrepresentative sample.

Sub-groups.

Table 1 gives details of the children in the three sub-groups. Girls outnumbered boys even more markedly than in the total sample. An analysis of the data revealed no significant differences in scores between the sexes, but the possible effects of an uneven sex distribution would need to be investigated further.

TABLE 1
SUB-GROUP TEST RESULTS.

Source	Group VMS	Group RSR	Group C	Analysis of Variance F ratio
N	18 (6 boys, 12 girls) Mean age : 109.50 months	22 (8 boys, 14 girls) Mean age : 108.05 months	21 (6 boys, 15 girls) Mean age : 108.29 months	—
ITPA Visual Motor Sequencing Test: Mean Score (range in parentheses) ..	15.83 (12-24)	10.18 (5-13)	13.76 (4-19)	—
Stambak Reproduction de Structures Rythmiques Test: Mean Score (range in parentheses)	9.94 (3-18)	15.00 (11-17)	13.52 (5-18)	—
Schonell Spelling Test of Irregular Words: Mean Score (sd in parentheses)	20.50 (13.53)	22.64 (13.75)	24.24 (11.83)	0.36 (NS)
English Picture Vocabulary Test: Mean Scores (sd in parentheses)	85.33 (16.43)	94.59 (18.00)	99.10 (17.61)	2.77 (NS)

Analysis of variance showed no significant differences between sub-group scores on the Schonell Spelling and EPV tests. The standard deviations for the Schonell Spelling test were large but similar for the three groups. They reflected the wide range of spelling achievement found in this age group in the schools included in the study. No significant differences were found between the Schonell test scores of the groups when these were adjusted by analysis of covariance for variations in EPVT scores.

Table 2 shows the frequencies and proportions of errors made by each group under the various headings of the error classification. Significant differences at the 1 per cent level were found in the proportions of errors in three categories. Group RSR made fewer syllable confusions, whilst Group C made more single letter insertions and fewer unclassifiable errors. No significant difference was found in the proportion of plausible phonic alternatives made by each group.

TABLE 2
GROUP ERROR TYPES: RAW AND PROPORTIONAL SCORES.

Error Type	Percentage in Livingston Study	Percentage in Present Study	Error Sub-types (where appropriate)	Group VMS	Group RSR	Group C	Chi Square (differences between sub-groups)
				Raw Score (percentage of this error type in parentheses)	Raw Score (percentage of this error type in parentheses)	Raw Score (percentage of this error type in parentheses)	
Omissions	28.0	19.9	Single letter	27 (19.70)	49 (35.77)	53 (38.69)	5.01
			Syllable	3 (2.19)	2 (1.46)	3 (2.19)	Too few
Insertions	14.4	9.8	Single letter	13 (19.40)	18 (26.87)	36 (53.73)	11.15**
			Syllable	—	—	—	—
Transpositions	6.0	6.5	Inversion ..	12 (26.67)	17 (37.78)	7 (15.56)	3.76
			True transposition ..	4 (8.89)	2 (4.45)	3 (6.67)	Too few
Doubling	9.6	9.3	'One-for-two'	9 (14.29)	23 (36.51)	24 (38.10)	4.94
			'Two-for-one'	4 (6.34)	—	3 (4.76)	Too few
Confusions and substitutions	39.8	28.8	Single letter	40 (20.20)	49 (24.75)	48 (24.24)	0.01
			Syllable ...	23 (11.62)	8 (4.04)	30 (15.15)	13.80 **
Homophones ..	1.4	0.7	—	3 (60.00)	1 (20.00)	1 (20.00)	Too few
Perseverations	0.3	0.6	—	2 (50.00)	—	2 (50.00)	Too few
Unclassified ..	0.5	24.6	—	61 (36.09)	74 (43.79)	34 (20.12)	20.52 **
P P As	—	—	—	79 (43.89)	100 (45.45)	115 (54.76)	3.20

** $P < .01$.

The table also shows the distribution of errors found in Livingston's study. It can be seen that the percentages of errors in the present study correspond in rank order to those of Livingston, except for the category of unclassified errors. The larger proportion of errors of this kind in the present study may well reflect a more cautious approach to classification where any doubt existed, rather than any differences between the samples of children used. The high proportion of unclassifiable errors led in consequence to a reduction in the proportions of the remaining error categories.

All three schools in the sample, when asked about their methods of teaching reading, replied that they used mixed methods (but not i.t.a.). No significant differences in the distribution of error types were found between the schools.

Words most frequently misspelt by the VMS and RSR sub-groups.

Analysis of the sub-group errors showed that children in the VMS and RSR groups differed in the words which they most frequently misspelt. The following words were incorrectly spelt by six or more children in one or other of the groups. Below each word are the offerings they made.

<i>Merry</i>		<i>World</i>		<i>Hardly</i>	
VMS	RSR	VMS	RSR	VMS	RSR
mery (3)	mery (2)	would (2)	would (2)	hardley	hardley
marry (2)	marry	wourld (2)	wourld	hardle	hardl
mercy	mercy	wirld	wodle	haride	hardy
meny	mary	wouth	ward	hargle	hadly
marny		wloud		hrard	hadten
meay		wlorld		hrge	heady
many		ward		hain	
		wold		hoewlind	
				doneley	
				fedl	
<i>Ribbon</i>		<i>Sudden</i>		<i>Gallery</i>	
VMS	RSR	VMS	RSR	VMS	RSR
ribon	ribon (4)	suddun	suden (2)	galery	galery (2)
ribbin	ribbin	shoulden	suddern		gallary
riben	ribin		soden		galary
rubb	rebon		suned		galerie
	riddon		souhen		garnerie
					garrie

On a subjective evaluation of these misspellings, it appears that there was a greater tendency for the RSR group children to preserve the syllabic rhythm and consonant structure of the words (24, compared with 16, of the 37 misspellings). Also, it was apparent that the RSR group children made attempts to spell a wider range of words.

DISCUSSION

It was interesting to note that in a sample of 140 children two groups with such disparate performance on the two memory tests could be found. The VMS group mean scores were above, and the RSR group's below, the combined mean score of all three groups on the VMS test. Conversely, the RSR group's mean score was above, and the VMS group's below, the combined mean score of the three groups on the RSR test. The results of these two specific tests cannot, of course, be taken to imply that the children differed in visual and auditory memory in a more general sense.

In what respects were the VMS and RSR tests analogues of the types of memory functions involved in spelling? Memory is likely to be involved in at least two stages of written spelling; firstly in the initial 'planning' of the graphic movement, and secondly in the 'checking' of what has been written. The sequential aspects of the tests would seem to be relevant to both these stages. The tests were not sufficiently specific to measure any discrete aspect of memory but the tasks probably relied on shorter- rather than longer-term memory. In dictation the child presumably uses shorter-term auditory memory in order to recall the word just spoken. It may be as Bannatyne and Wichiarajote (1969) and Peters (1970) suggest, that the word which is heard is then 'rehearsed' in sub-vocal articulation by the child before he writes it down. It seems likely that there are considerable individual differences in children's responses to the orally dictated word, involving kinesthetic and visual, as well as language skills and a knowledge of spelling patterns. Longer-term auditory memory may be concerned at the checking stage when the child may, for example, decode graphemes back into phonemes to ensure accuracy in a polysyllabic word. There would not seem to be much use of shorter-term visual memory in spelling to dictation, but the child probably employs longer term visual memory when he checks the word he has written to see if it 'looks right,' or corresponds to remembered letter sequences.

The absence of any significant differences between the sub-group mean scores on the spelling test might be taken to indicate that the two tests did not, in fact, measure functions relevant to spelling. However, the finding of proportional differences in the types of spelling errors made by the two groups weighs against this inference, particularly as the pattern of differences corresponds meaningfully to the contrasted memory tasks. Group RSR's avoidance of syllabic confusions could be ascribed to their superior auditory memory, whereas Group VMS's avoidance of letter insertions and their tendency to avoid 'one-for-two' doubling errors, single letter omissions and inversions of adjacent letters, fits in with their superior performance on the visual memory test. As far as the second classification was concerned, it had been hypothesised that the RSR group would make a disproportionate number of plausible phonic alternative errors. The fact that they did not might well be accounted for by the argument that plausible phonic alternative offerings presuppose competence at phoneme-grapheme association as well as in auditory discrimination and memory. The errors of the C group were characterised in the main by a tendency on the part of these children to apply the 'rules' of phoneme-grapheme association. Such rules would include those which were specifically formulated as well as inferences built up by the child about the probability of letter sequences. The C group also made fewer unclassifiable errors and offered more plausible phonic alternatives. If one characterises the VMS, RSR and C groups by the level of their mean scores on the memory tests, one might postulate that the VMS and RSR groups capitalised on their high memory functions in the acquisition of spelling and that the C group, in the absence of superiority at either visual or auditory memory, might have relied more on rule following to help them achieve their performance.

The results of the study appear to point to a possibly crucial aspect of the way in which cognitive functions subserve the achievement of basic educational attainments. It is clearly impossible to state that spelling, for example, depends on a given level of specific cognitive functioning, except possibly a minimal level, but from the present study it could be argued that each of the groups achieved its level of spelling by a different combination of functions. The extent to which a deficient function might handicap an individual child in spelling could

well depend on the levels of his other relevant skills. It is hardly surprising, therefore, that studies relating visual and auditory memory to spelling have often produced inconsistent findings.

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(Manuscript received 29th April, 1971)

THE PERFORMANCE OF PUBLIC SCHOOL BOYS ON A HIGH LEVEL TEST OF REASONING

By A. W. HEIM AND K. P. WATTS

(*Psychological Laboratory, Cambridge*)

SUMMARY. 1,439 boys, members of four public schools, took Test AH6 AG. This is a high-level test of reasoning whose total score can be broken down into a verbal (V) and a numerical-plus-diagrammatic (N + D) subscore. These three measures were compared with the boys' GCE results at O-level and A-level.

Significant correlations were obtained between the test and GCE, for most school subjects. A tendency was found for V to yield the best results in arts subjects; in mathematics and science, however, total score in general yielded a closer association than did N+D. AH6 AG proved to be a good predictor of all-round scholastic ability on the criterion of number of O- and A-level subjects successfully taken.

INTRODUCTION

AH6 is a test of high-level reasoning, intended for adolescents and young adults from the top 20-25 per cent of the population as judged by intelligence and education. It comprises two forms, SEM (for scientists, engineers and mathematicians who are qualified, or in training) and AG (for arts and general subjects). These two forms are of equal level of difficulty but they differ in their proportion of verbal, numerical and diagrammatic items. SEM's questions are equally divided among the three biases whereas AG consists of 50 per cent verbal, 25 per cent numerical and 25 per cent diagrammatic questions (Heim *et al.*, 1970). In both forms of AH6, the various types of item are presented cyclically throughout the test and Subjects* are instructed to take the questions in whatever order they like.

In this paper the AG form only is considered, since the majority of the Subjects were tested before they began serious specialisation in arts or sciences and it was thought desirable that all of them should take *the same* intelligence test. In fact, a few of the GCE A-level candidates took a mixture of arts and science subjects, such as Biology, Economics and Geography.

In the AH6 test manual, the validation consists of correlations with other tests and with academic examinations at university, college of education and grammar school. The validation here concerns the GCE O- and A-level results of public school boys.

THE SUBJECTS

The Subjects were 1,439 boys from four public schools. All the pupils in schools X, Y and Z were tested, apart from a few absentees, but in school W only the first-years (mainly 13-year-olds) were tested. There were 349 from school X, 476 from school Y, 546 from school Z and 68 from school W. The four schools come roughly in the middle of the public school pecking order. Figure 1 shows the relationship between schools, X, Y and Z on total AG score.

* 'Subjects' spelt with a capital S throughout this paper designates the people taking the tests. By this means, the distinction is clearly shown between them and school 'subjects' such as Physics and History.

The dot, shown for age 13+, at 22.4 gives the position of the mean score of the 62 13-year-olds from school W. It may be seen that the test results of the four schools differ little from one another. Figure 2 shows the relationship between test score and age, Subjects of each age-group being divided into five grades : A=top 10 per cent, B=next 20 per cent, C=middle 40 per cent, D=next 20 per cent and E=bottom 10 per cent. The test score norms rise fairly steadily, year by year, from 13+ to 17-and-18, and this holds equally well for the verbal (V), the numerical-plus-diagrammatic (N+D) and the total.

FIGURE 1
TOTAL AH6 AG SCORES GAINED BY DIFFERENT AGE GROUPS.

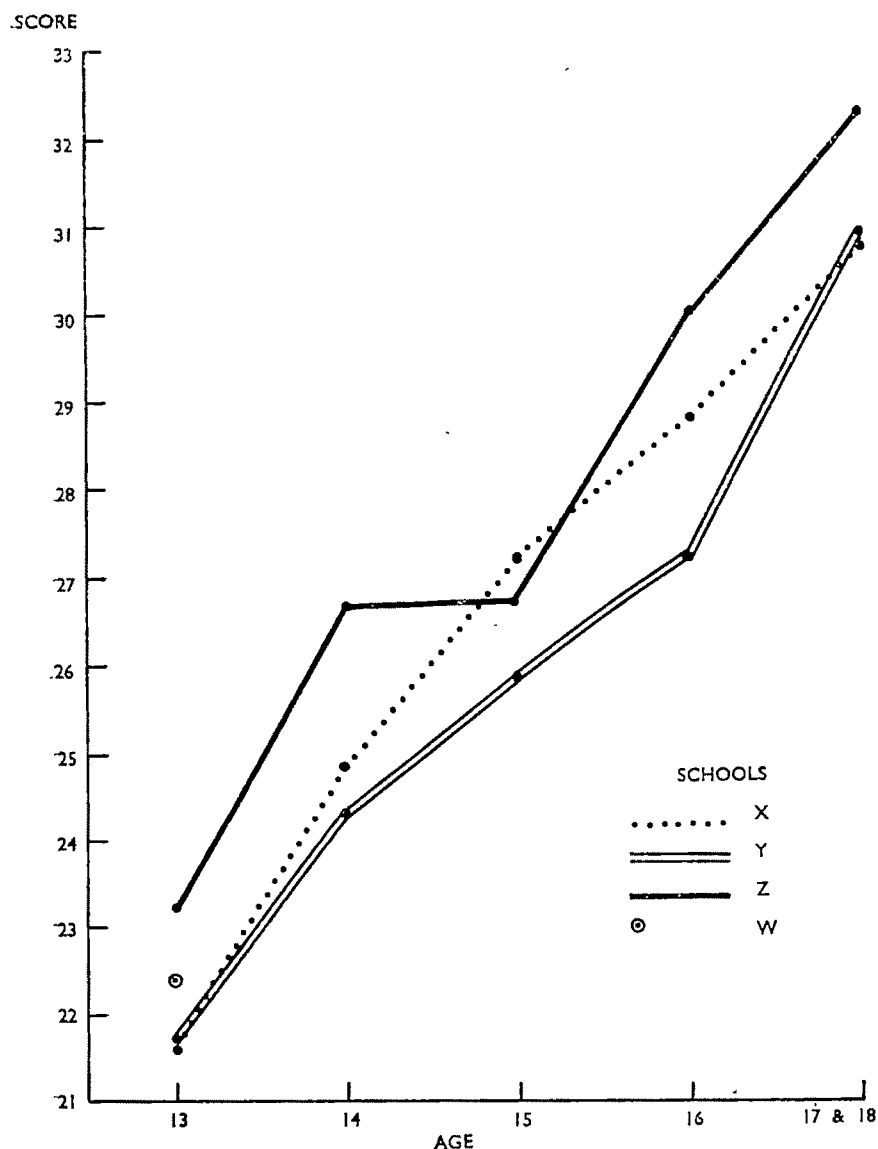
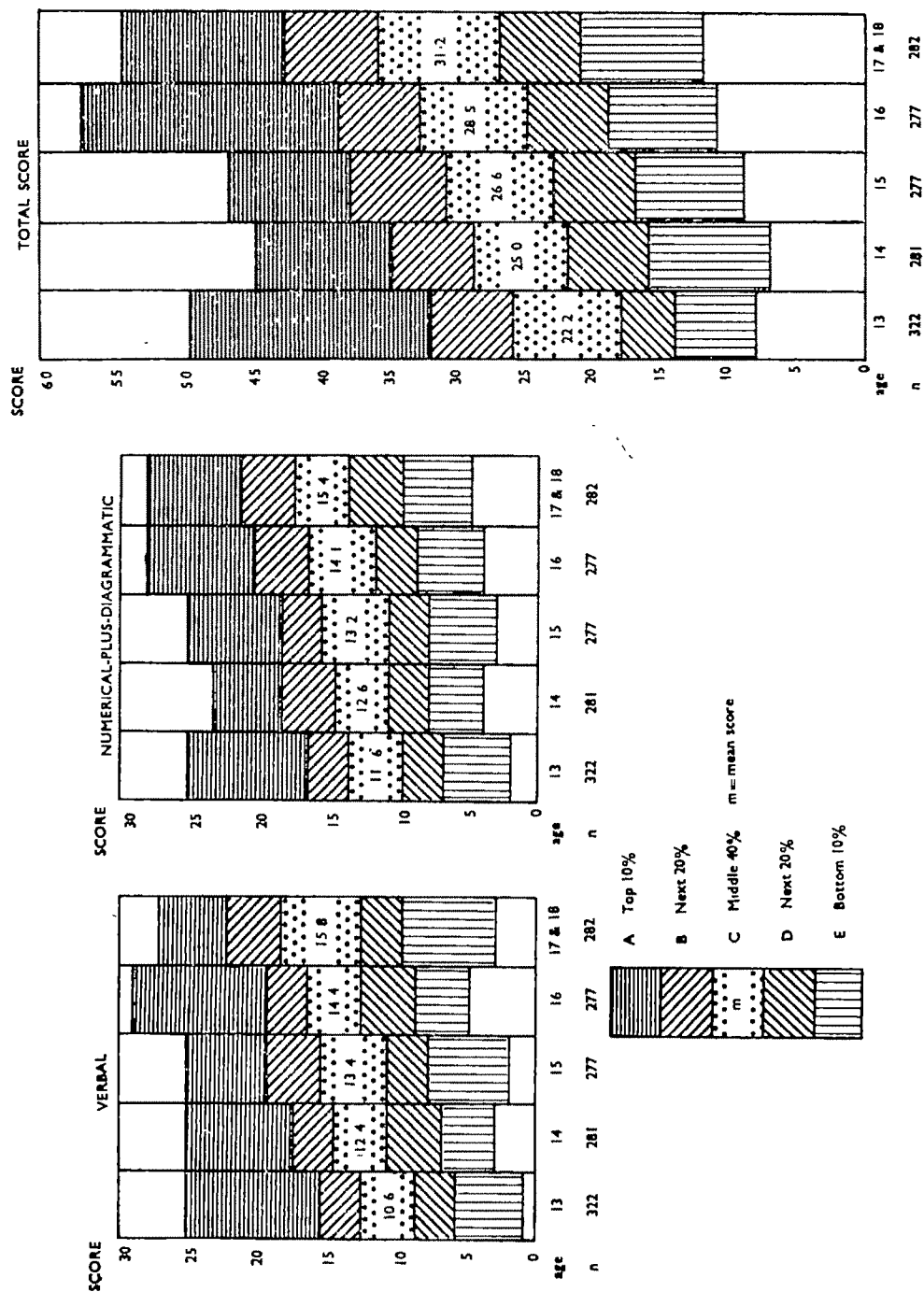


FIGURE 2

AH6 AG PERCENTAGE BAR CHARTS



Public schools were chosen for this enquiry because (a) they yield a wider range of intelligence than do grammar schools, extending downwards considerably further. (b) Virtually all the pupils take some GCE O-levels, whereas the comprehensive schools present some of their pupils for GCE and some for CSE. Using comprehensive school boys would have complicated our test/examination comparisons and would have substantially reduced the numbers in the sub-groups.

The numbers tested in each age-group are shown in Table 1.

TABLE 1
NUMBERS TESTED IN AGE-GROUPS.

Age	13+	14+	15+	16+	17+ and 18+
N	322	281	277	277	282

The 17-year-olds and 18-year-olds are grouped together because there were only 73 boys of 18+. Moreover, this group of older boys was probably not representative, owing to the tendency of some of the brighter sixth-formers to leave school before their eighteenth birthday.

PROCEDURE AND RESULTS

A.—Method.

The testing at schools X and Y was carried out in May, 1970, and at school Z in September, 1970. As we tested the former two schools towards the end of the academic year our sample of 13-year-olds was not fully representative of all public school 13-year-olds: nearly all these Subjects were aged between 13:6 and 13:11. To redress the balance, the subsequent year's new boys at schools X and Y were given the test in October—as were the new boys at school W. Permission was not granted to test the whole of the latter school. At school X, the test was administered in the classrooms to individual forms, whereas at the other schools all the members of each year-group were tested simultaneously.

Correlations between AH6 AG and GCE have been calculated only when N is at least 15. This necessitates the exclusion of 10 A-level subjects (e.g., Geology, Music) and four O-level subjects (e.g., British Economic Organisation, Italian). The results of boys resitting an examination for the second (or third) time are excluded. For the purposes of our comparisons, only the results of those GCE examinations taken in the summer of 1970 are used. For schools X and Y, test AH6 AG was taken a few weeks *before* GCE, and for school Z approximately three months *after* the relevant examinations. This reduced the number of boys for whom A-level results were available in school Z, since many of the boys did not come back to school after taking A-levels. Whilst some probably came back because they wished to improve their A-level results, others came back for a term to take Oxbridge scholarship examinations. Although the numbers are smaller, they probably do cover the range of ability.

O-levels were taken mostly by fifth-formers but there were some exceptions. For instance, brighter boys at schools X and Y tended to take one or more of the following a year early: English language, Mathematics, Latin, French.

Divinity was taken in the lower sixth at school Y. These anomalies of form-membership and month when tested are mentioned in order to give an accurate overall picture. If they have any effect on the examination/test relationship, they would be more likely to depress slightly the correlations than to raise them.

B.—GCE A-level Examination.

(i) *Specific school subjects.*

A-level results are awarded one of seven grades. A to E are A-level passes, O denotes a pass at O-level and F denotes failure. For purposes of statistical computation, these have been called numerically 1 (best) to 7 (fail). As may be seen in Table 2, not all grades are awarded in all examinations for the present sample.

Table 2 shows the correlations between AH6 AG score and GCE A-level results. The school subjects are presented in order of AH6 mean score (total). The results are shown for V and N+D scores separately, as well as for total test score. Since the GCE grades are not normally distributed for all school subjects, Spearman's rho has been used in preference to r.

TABLE 2
COMPARISON OF AH6 AG SCORES WITH A-LEVEL EXAMINATIONS.

	Notes on Examination Grades Awarded	AG Mean Score			Spearman's rho Correlations			N
		V	N+D	Total	V	N+D	Total	
Mathematics		17.9	19.6	37.5	0.35†	0.15	0.36†	56
Physics	No Fs	17.8	18.7	36.5	0.42†	0.27*	0.42†	62
Chemistry ..		18.0	17.4	35.3	0.49†	0.61†	0.54†	56
German	No Es or Fs ..	18.6	16.5	35.1	0.47	0.42	0.49	15
Economics ..	No As	17.3	15.9	33.2	-0.03	0.21	0.15	42
Biology		16.9	15.5	32.4	0.36*	0.57†	0.49†	33
Latin	No As	16.5	15.7	32.2	0.22	0.27	0.13	17
French		17.1	14.3	31.5	0.29	0.22	0.29	35
History		16.2	14.6	30.8	0.27*	0.22	0.31*	34
English ...	No Os or Fs .	16.5	13.8	30.3	0.28*	0.07	0.16	57
Geography ..		15.3	31.6	28.9	0.51*	0.15	0.37	20

* $P=0.05$.

† $P=0.01$

‡ $P=0.001$

It may be seen that mathematicians head the list with a mean of 37.5 (out of a possible maximum score of 60), closely followed by physical scientists, whilst English scholars and geographers bring up the rear with means of 30.3 and 28.9, respectively. These results are roughly in line with those obtained in

previous investigations of this kind (Wallace, 1952; Entwistle, 1971). We are inclined to ascribe these findings to the fact that it is deductive reasoning and accurate observation that are most essential for success in Mathematics and Physical science—to a far greater degree than in arts subjects—and these are, of course, the qualities that are assessed in intelligence tests.

It may be partly for this reason that the majority of the highly significant correlations ($P < 0.001$) occur in the top three lines of Table 2. This may be due, too, to the greater objectivity possible in marking Mathematics and Physical science as opposed to examinations in arts subjects. But significant correlations at a less impressive level do obtain in the lower half of the table, notably in Biology and in History. It may be seen that the correlations for German are high—all three over 0.4—but these fail to reach significance, since $N=15$ only.

One of the most interesting points about Table 2 is the high predictive value of the verbal part of AH6 AG. Not only is it generally superior to $N+D$ (even in Mathematics and Physics) but it yields more correlations which are significant than does total AG score, to which it contributes roughly half. The exceptions to this are Chemistry, Economics, Biology and, interestingly, Latin—for all of which $N+D$ yields the highest correlations, of the three test indices.

(ii) *Overall success at A-level.*

In order to obtain an overall picture of the degree of agreement between A-levels and AG, the mean AG score of those taking three A-levels and those taking only two were compared. It was predicted that the latter would be lower since most boys who were capable of taking three would do so. (There was one notable exception, however, a bright sixth-former aged 17 who took Mathematics and Physics in 1970, gaining Grades 1 and 2, who planned to take Biology and Chemistry in 1971.) The results are shown in Table 3. Thus, boys taking three A-levels do indeed gain a higher mean AG score than do boys taking only two, the difference being significant at the 0.001 level.

TABLE 3
COMPARISON OF AH6 AG SCORES WITH NUMBER OF A-LEVELS TAKEN.

	Total AG Score	Difference	t	P	N
3 A-levels	34.3	5.8	4.30	0.001	122
2 A-levels	28.5				32

Members of the sub-group who took three A-levels were further considered, using the sum of the three grades gained by each boy. The range thus obtained was from 3 (excellent: three grade As) to 20 (poor: one grade O and two failures). In view of the extensive range and the near-normal distribution of these summed grades, a product-moment correlation was used for the comparison with AH6 Scores, $r=0.40$, $P < 0.001$.

Most of the boys in this group took either three arts subjects or three science subjects. Arts people tend to score relatively highly on the verbal questions as compared with $N+D$, and scientists tend to score more highly on $N+D$ (see Table 2). In view of this difference, it would have been unenlightening to look at the V or $N+D$ scores separately.

C.—GCE O-level Examination.

(i) *Specific school subjects.*

Table 4 shows the correlations between AH6 AG score and GCE O-level results for all school subjects where N exceeds 20. (There were no cases where N was greater than 15 and less than 20.) In addition the mean O-level grade is given (column 2). 1 is the highest and 6 is the lowest pass O-level grade, 7-9 indicating failure. For school Z we do not have the O-level grades gained by some of the failures: in those cases we have treated them as grade 8.

TABLE 4

COMPARISON OF AH6 AG SCORES WITH O-LEVEL EXAMINATIONS.

	GCE Mean Grade	AG Mean Score			Spearman's rho Correlations			N
		V	N+D	Total	V	N+D	Total	
Additional Maths.	5.0	16.6	15.8	32.4	0.32†	0.40†	0.42‡	104
M.E.I. Maths. ¹	3.8	15.6	16.3	31.8	0.32	0.32	0.32	25
Technical Drawing ²	4.6	15.4	15.8	31.2	0.25	0.30	0.36	31
Chemistry	4.7	15.7	15.1	30.8	0.29†	0.29†	0.33‡	110
Physics	4.4	15.7	15.0	30.7	0.40†	0.34†	0.43‡	113
S.M.P. Maths.	4.0	15.9	13.5	29.4	0.42	0.39	0.45	21
Latin ³	4.9	15.0	14.2	29.2	0.27†	0.25†	0.29‡	150
Biology	5.2	14.3	14.1	28.4	0.47†	0.34†	0.44‡	141
German	4.3	14.2	13.8	28.0	0.36†	0.18	0.32*	54
Divinity ⁴	5.1	14.0	13.8	27.9	0.39†	0.19	0.27*	79
French ³	4.1	13.9	13.7	27.6	0.24†	0.10	0.21‡	280
English Literature	4.8	13.9	13.6	27.5	0.29†	0.17†	0.27‡	276
English Language ³	5.0	13.7	13.3	27.0	0.35†	0.24†	0.34‡	241
Mathematics ³	5.0	13.5	13.3	26.8	0.46†	0.49†	0.54‡	239
Art	4.6	12.8	13.5	26.3	-0.09	0.05	-0.03	32
History	5.5	13.2	12.9	26.2	0.31†	0.23†	0.31‡	171
Chemistry+Physics	6.2	12.8	12.9	25.7	0.24†	0.28†	0.31‡	125
Geography	5.6	12.3	12.7	25.0	0.23*	0.30‡	0.26†	117

* $P=0.05$ † $P=0.01$ ‡ $P=0.001$ ¹ Bright fourth form boys from school X.² Half lower sixth and half fifth form scientists from schools X and Y.³ For schools X and Y some bright fourth formers are included, see text p 43.⁴ Lower sixth boys from school Y.

Again the school subjects are presented in descending AG total score. It will be seen that this order is somewhat similar to that in Table 2, apart from two school subjects which look 'out of position,' namely, Mathematics and Chemistry+Physics. The reasons for these apparently anomalous results are as follows: since Mathematics is taken by virtually all the boys, only an 'average' AG score is gained. Moreover, the mean is further depressed because bright boys take this examination a year earlier and their AG score will be lower at 15 than it would be at 16. On the other hand, the 'Additional Mathematics' and 'MEI Mathematics' (a type of modern mathematics) are taken, respectively, only by those who shine at Mathematics and those who are considered sufficiently advanced to take the examination a year early. The Chemistry+Physics examination is taken by arts pupils only, i.e., by those who are thought incapable of coping with the more specialised physical science papers.

These results are still more encouraging than the A-level ones, probably because the numbers are bigger and the boys far less highly selected. It may be seen that 39 of the 54 correlations are significant at the 0.05 level or better. When considering these figures, it must, of course, be borne in mind that the 'total' correlations are not independent of the V and the N+D scores which comprise the total. Nevertheless, there are several school subjects in which the three correlations differ markedly, e.g., German and Divinity. Moreover, 26 of the 54 correlations are significant at the $P < 0.001$ level and, this time, the highly significant findings are not confined mainly to Mathematics and Science. Latin, Biology, French, English literature and English language, History and Geography examination results all yield statistically significant associations.

In general, with the O-levels, total score is a slightly better predictor than is verbal score (and markedly better than the N+D). But there are naturally differences here between the arts and science subjects. If we ignore Geography (as an arts-science) and Art (as opposed to arts), Table 4 yields the following differences: V does marginally better than total score for five of the seven arts subjects (Latin and History being the exceptions—the latter being identical on V and Total). Total score, however, is the better predictor for seven of the nine science subjects (Biology being the exception and MEI Mathematics yielding equal correlations on the three AG scores). Four of the nine science subjects correlate more highly with the N+D than with the V score (for two subjects, MEI Mathematics and Chemistry, the correlations with V and with N+D are equal). Art is the only school subject which produced negative (albeit insignificant) correlations.

These results do not—and, of course, cannot—take into account differences in the proficiency of different teachers. We may cite as an example of the importance of this the fact that in school Y 20 fourth formers took O-level French, of whom 18 gained Grade I and two gained Grade 2 in the examination! It may be observed that the mean O-level grade for French for the three schools jointly is 4.1.

(ii) *Overall success at O-level.*

In addition to our interest in the relation between AH6 AG and specific O-level examinations, we were curious to know whether any agreement obtained between AG and overall success in O-levels, regardless of the particular school subjects taken. For this purpose, we looked at all the fifth-formers and all their O-level examination results (whether taken in 1969 or 1970). Table 5 shows the number of O-levels taken by these boys.

TABLE 5
NUMBER OF O-LEVEL EXAMINATIONS TAKEN.

Number of O-levels	11	10	9	8	7	6	5	< 5	Total
Number of boys ..	2	25	54	86	99	11	3	0	280

Since all took at least five O-levels, the sum of *the best five* O-level grades was calculated for each boy. Table 6 shows the results of comparing this index with AG score. Product-moment correlations are used as this combination of grades gave a wide range (5, the best, to 45, the worst) which was approximately normally distributed.

TABLE 6
CORRELATIONS BETWEEN AG AND SUM OF BEST FIVE O-LEVEL GRADES (N=280).

AH6 AG	r	P
Verbal	0.50	.001
N+D	0.43	.001
Total	0.53	.001

Thus the test would appear to be a useful predictor of general scholastic aptitude. Total score is a slightly more satisfactory measure than is verbal score. N+D does rather better than might have been expected from the results shown in Table 3.

We looked also at (a) the best *seven* O-level grades and (b) the *mean grade* of all O-levels taken by each boy. Comparisons of these two indices with AG total yielded very similar correlation coefficients (respectively, $r=0.50$ with $N=266$; $r=0.51$ with $N=280$). In view of this similarity, we did not calculate the figures for V and N+D separately.

(iii) *Comparison of public schools with grammar schools.*

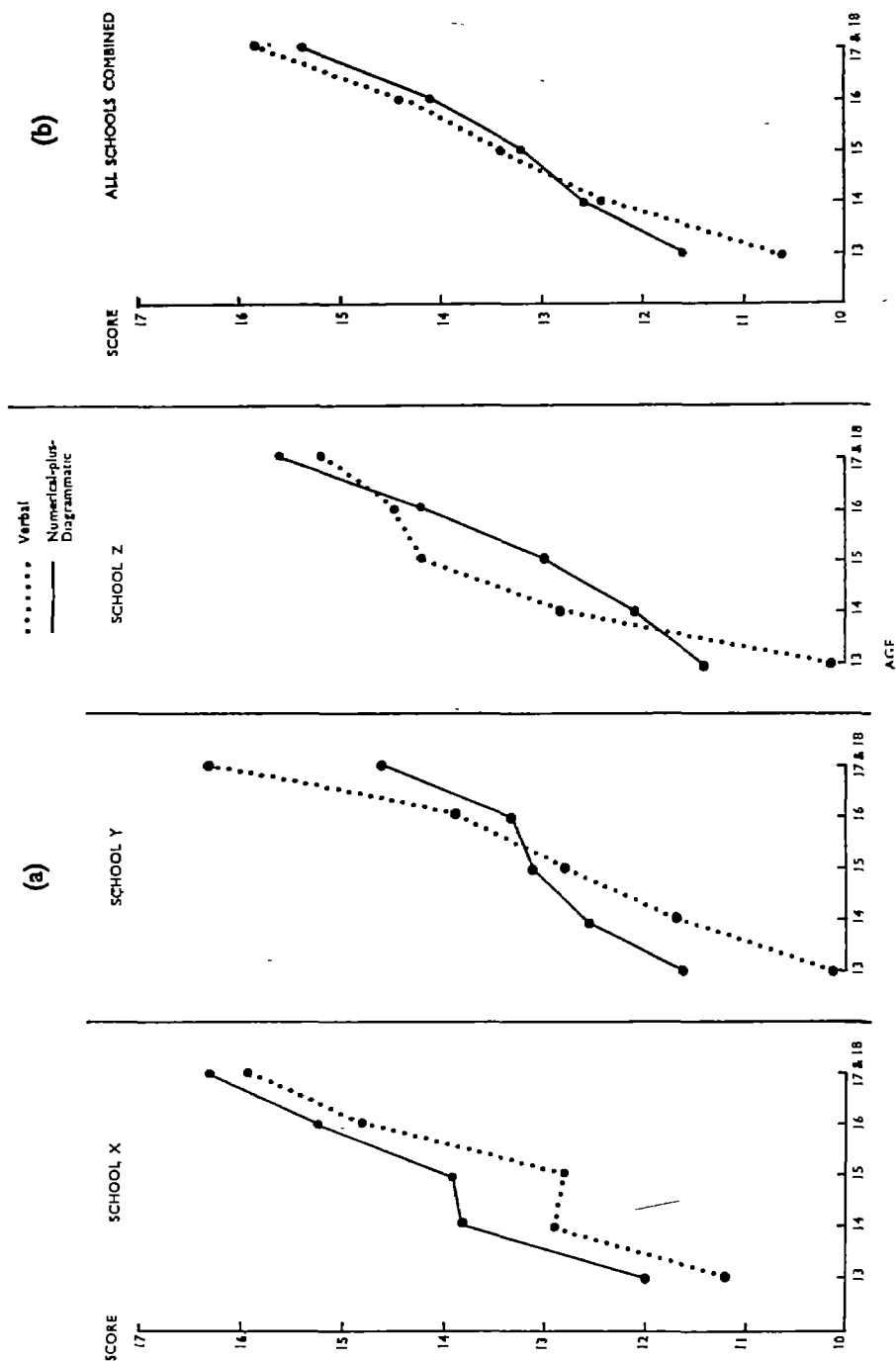
It is of interest to compare the above results with those given in the AH6 Manual (Heim *et al.*, 1970) for co-educational grammar school children. The overall index there was with the *best four* O-level results and with the number of O-level passes. The correlations are shown in Table 7.

TABLE 7
CORRELATIONS FOUND WITH GRAMMAR SCHOOL CHILDREN (N=174).

Correlation with	AH6 AG	r	P
Sum of best four O-level grades	Verbal ...	0.47	.001
	N+D	0.34	.001
	Total	0.48	.001
Number of O-level passes	Verbal ...	0.36	.001
	N+D	0.17	NS
	Total	0.32	.001

FIGURE 3

COMPARISON OF V AND N+D SCORES AMONG THE SCHOOLS.



Thirteen of the 18 subjects in Table 4 were taken by the grammar school children. The public school correlations were higher for all three indices (V, N+D and total) for Mathematics, Additional Mathematics, Biology and History. They were lower for all three for Chemistry, Physics, English Literature and Art. For the other five subjects—German, French, English Language, Chemistry+Physics and Geography—nine of the 15 correlations were higher for the public school boys, four were lower, and two were the same.

Thus, as predicted, the agreement was in general somewhat higher for the public schools. This is most likely due to the greater range of scores: the standard deviations were approximately one mark lower for the sixth form and fifth form grammar school children than for the public school boys of similar age.

D.—Differences among the four schools.

In Figure 3 (a), the V and the N+D scores are compared, age by age, for schools X, Y and Z. Figure 3 (b) shows the mean V and N+D scores for the four schools combined. For school W, N for 13-year-olds=62 and N for 14-year-olds=6.

These figures indicate that there are slight differences in 'bias' among the three main schools. The boys from X are evidently better on N+D at all stages; whereas the Y boys show more N+D ability at 13 to 15, after which they tend to score more highly on the verbal items. No such generalisation can be drawn regarding school Z. Thus, overall—as can be seen from Figure 3 (b)—the V and the N+D results for the total population tested are very close, and almost exactly parallel in every sense. The only age at which these two curves differ significantly is at 13 ($P=0.001$). Thus, it is only the younger boys who find the N+D items consistently easier than the verbal questions.

SUMMARY AND CONCLUSIONS

(1) 1,439 Public school boys took Test AH6 AG in 1970. All the boys in schools X, Y and Z were tested but in school W permission was granted to test only the new boys.

(2) Correlations were calculated between Test AG scores and (a) GCE A-level examinations and (b) GCE O-level examinations. Significant associations were found in most school subjects between these examinations and the test. Total score tended to yield the highest correlations, with science and mathematics subjects, both at A- and O-level; whereas verbal score fared better with arts subjects. N+D score, whilst doing relatively well with scientific subjects, gave in general the least satisfactory associations. A highly significant relationship was found between overall success in GCE, both levels, and AH6 AG score.

(3) Negligible differences were found among schools X, Y and Z, with respect to total test score and differences between V and N+D score. The only exception to the latter point was found at 13 years of age, where N+D scores were significantly higher than V scores.

(4) It would appear that AH6 AG is a good measure of scholastic aptitude, as assessed by academic examinations. Since total AG score proved in many cases to be a better predictor than V or N+D alone, we feel that the policy of alternating verbal with numerical-and-diagrammatic questions within the test is well justified. To some extent AH6 AG enables future arts men and scientists to identify themselves by means of their choice of, and their ability to cope with, different types of test-item.

ACKNOWLEDGMENTS—Our thanks are due to the headmasters of the schools for their kind co-operation ; to Mrs. V. Simmonds for drawing the figures and helping with the testing ; and to the Medical Research Council for financial support.

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(Manuscript received 21st June, 1971)

AN APPLICATION OF REPERTORY GRID TECHNIQUES TO THE STUDY OF CHOICE OF UNIVERSITY

BY W. A. REID AND B. J. HOLLEY

(Teaching Research Unit, University of Birmingham)

SUMMARY. A two-stage investigation of applicants' choices of university was undertaken, using group versions of tests based on Kelly's repertory grid technique. In the course of the first stage nine major constructs were elicited from 32 subjects, and these were used as provided constructs in a second stage test which was completed by 70 subjects. Data were also collected on the personal and educational backgrounds of these subjects, and analyses carried out to indicate possible relationships between the choices they expressed on their UCCA forms, their assessment of universities (both those they had chosen and some they had not) on the constructs, and the background data. It is concluded that these analyses provide important insights into the determinants of the choices which applicants make, and indicate that repertory grids may profitably be used on a group basis to investigate choice situations of this type.

INTRODUCTION

THE present rapid growth in the numbers of applicants for university places, coupled with equally dramatic increases in the scale and variety of higher education provision, poses in an acute form the problem of providing for an optimal matching of applicants to places. If, as seems likely, the choices expressed by the applicants themselves are to continue to play a major part in determining what outcomes their applications have, then the development of appropriate techniques both for advising candidates, and for making decisions upon their applications, must depend upon the achievement of a better understanding of the factors which lead to the declaration of preferences for particular universities, university departments, or courses (Rossi and Coleman, 1964). The focus of interest in this study is upon choice of university.

It is hypothesised that, although environmental factors may exert powerful influences over applicants' decisions to apply to particular universities, these influences only become effective through interaction with the images of universities which applicants come to possess. It is with the exploration of these images, and the study of their relationship to environmental factors, and to the choices which applicants actually make, that the research described in this paper is concerned.

The work of Kelly on personal construct theory not only provides a potentially fruitful model for exploring the nature of applicants' perceptions of universities, but also suggests a technique for making empirical investigations of them (Kelly, 1955). Kelly proposes that each individual has access to a limited number of dimensions, or 'constructs' along which he evaluates sets of cognate phenomena in his universe; these might be people, or institutions, or particular classes of ideas or events. Furthermore, he suggests that constructs which the individual makes use of in his evaluations of phenomena can be regarded as bipolar; that is to say, definable by pairs of antithetical adjectives or expressions—'intelligent-unintelligent,' 'makes me feel uncomfortable—makes me feel comfortable,' and so on. Notions of the ways in which the constructs available to particular individuals vary in their complexity and of the ways in which they relate to one another within conceptual systems have been developed by Kelly and others (Kelly, 1955; Hinkle, 1965; Adams-Webber, 1967).

The empirical technique suggested by Kelly for eliciting constructs from individuals is based on the proposition that, when faced with a triadic group of cognate phenomena—'father, wife, a teacher I liked'—a relevant construct is defined by the subject's self-report of the characteristic which he sees as shared by a specified pair drawn from the triad, and as possessed in an opposite sense by the odd one out—'unintelligent (father)—intelligent (wife, a teacher I liked)'. It then becomes possible to depict in matrices, or grids, the nature of the relationships which exist between the constructs so elicited and relevant classes of phenomena, and to use mathematical techniques to describe and explore them. These techniques are generally subsumed under the title of 'repertory grid methods' (Bannister and Mair, 1968).

Practically all the work which has so far been done in the elicitation and exploration of constructs has been based on Kelly's original concept of the technique as one suited to individual psychoanalysis, but the focus of interest of the present study suggested that an attempt should be made to use it on a group basis.

In order to do so it was important to establish, as a first step, whether reasonably stable construct patterns existed within groups of individuals, or whether candidates for university entrance were characterised by a high degree of idiosyncrasy in this respect. If the former were the case, then research leading to generalisable conclusions relevant to policy-making on university entrance would be a possibility; if the latter, then the role of research based on the repertory grid would become the rather different one of exploring aspects of individual psychology. This might produce results of interest to those finding themselves in a counselling role, but would have only limited relevance to public and institutional policies on university admission.

RESEARCH METHODOLOGY

(1) *Establishing the Constructs.*

One of the attractions of using a research technique designed to elicit constructs is that the subjects themselves are enabled to provide exhaustive definitions of the dimensions relevant to the research design. Subjective interpretation on the part of the researchers is not, of course, totally absent, but it is relatively much less important than in approaches which use searches of the literature, open-ended discussion, or theoretical models as bases for generating the dimensions to which the investigator should address himself. An added advantage in the present instance was the fact that it was a choice situation which had to be investigated. As choice is based on discrimination of some kind, a test involving actual comparisons of the items to be discriminated seemed to afford a useful approximation to the 'real' situation.

An instrument was devised which required subjects to consider 12 universities in 12 different triadic groupings, and to describe the constructs to which the comparisons gave rise. The universities chosen represented Oxford and Cambridge, the Older Civics, the Newer Civics, New Universities, and the ex-CATs. London was, however, omitted as possibly not having such a closely definable identity as the others.* This test was completed by 27 boys and 5 girls in three schools who had completed UCCA applications and were awaiting the outcomes of their A-level examinations. Eliminating any construct produced more than once by the same person, the total number elicited from the group was 198, or an average of 6.19 per subject.

* The complete list was: Aston, Bristol, Cambridge, Hull, Keele, Manchester, Nottingham, Oxford, Sheffield, Sussex, Surrey and York.

A second stage in the testing of this group required the subjects to relate each of the 12 universities to each of the constructs they had produced, and to show whether (a) they judged that the positive† pole of the construct applied to the university, or (b) they judged that the negative† pole applied to it, or (c) they considered that the construct 'did not apply to it in either sense.' 84 per cent of responses placed the universities on either the positive or the negative poles of the constructs. When constructs were grouped under broad headings such as 'Location' or 'Style and provision of teaching,' only very small variations were revealed within this overall percentage. Equally small variations were found when school differences and differences in the evaluations of individual universities were examined.

Through a process of rationalisation based partly on the wording of constructs and partly on similarities in their applications as revealed by simple grid analysis, a list of nine basic dimensions was established. These were :

<i>Positive aspect.</i>	<i>Negative aspect</i>
A. Good provision for the study of my subject.	Not such good provision for the study of my subject.
B. Established reputation.	Reputation yet to be made.
C. Arts bias.	Science bias.
D. Old university.	New university.
E. Unattractive, industrial surroundings.	Pleasant, non-industrial surroundings.
F. Compact buildings.	Buildings spread out.
G. Courses mainly traditional.	Courses with unique features.
H. Established redbrick.	Snobbish or pretentious.
I. Easy to enter.	Difficult to enter.

Detailed examination of the data, using these nine basic constructs, suggested that a high consensus existed in the group about the ways in which individual universities should be evaluated on the constructs, but that this consensus was quite loosely related to factual information about the universities concerned. (York, for example, was widely regarded as an 'old' university). These findings lent some support to the supposition that 'university image' might be an important factor in determining the choices made by applicants. Moreover, the fact that the test results were indicative of a high degree of consensus over individuals, schools, universities and construct groups suggested that it was worthwhile pursuing the group test approach.

(2) *Relating the Constructs to Other Factors in Decision-making.*

A second stage of the research was, therefore, designed to suggest answers to the following questions : (a) How do the evaluations which applicants make of universities in terms of constructs relate to the kinds of universities to which they choose to apply, or to the choice of particular universities ? (b) What kinds of relationship exist between these evaluations and factors such as the kind of A-level course applicants are following, the kind of university course they wish to take up, or their own personal backgrounds ? In order to relate the construct data to other variables it was necessary to adopt a standardised form of the grid which treated the nine construct groups as given. The legitimacy of such a procedure is still a matter of debate (Adams-Webber, 1970), but it is far from clear that it is necessarily inappropriate, provided that the subjects to be tested are of normal mentality and that the constructs have been carefully devised.

† The labelling of the poles as 'positive' and 'negative' was purely a matter of convenience and had no special significance.

This time the construct grid was completed by a different group consisting of 30 boys and 40 girls drawn from four schools in the Birmingham area. The wording of the constructs was that given in the list established from the previous research, but the subjects were asked to relate them to the universities which they had actually listed on their UCCA applications, as well as to an equal number which they had not chosen. These were drawn from the same list of 12 used at the earlier stage. In addition to this they gave information about parents' education, brothers' or sisters' higher education, A-levels studied, the stage at which they had decided to apply for university entrance, whether application had been made to a college of education, whether application was contemplated to a polytechnic, college of technology or college of further education, the kind of university course they preferred, and the preference code which they had used. (The policies employed by the schools for advising students were not, however, included in the investigation.)

As a check on the extent to which the construct list was exhaustive an item was added at the end asking the subjects to state 'any consideration which weighed more heavily than any of these with you when you were making your choices.' Twelve of the 70 respondents made entries under this heading. Of these, nine referred to the fact that the particular course that they wanted was only offered by a few universities (e.g., Drama, Fine Arts, American Studies), two referred to 'Geographical position' without elaboration, and one to 'Examination by continual (sic) assessment.' It seems likely that, for this group, just as for the first, the nine construct statements provided adequate coverage of the principal dimensions along which they evaluated universities. A breakdown of the actual choices made by the sixth formers in the sample is shown in Table 1.

TABLE 1
GROUPS OF CHOSEN UNIVERSITIES.

	Choices		Choices
Birmingham	14	Oxford, Cambridge, London	17
Bristol	15	Welsh, Scottish, Irish	31
Hull	29	Ex-CATs.....	15
Leeds.....	18	New Universities	35
Leicester	20	Other*.....	35
Liverpool	19		
Manchester	21	Total Choices	330
Nottingham	14		
Sheffield	26	Average No. of choices per student	4.7
Southampton	21		

* Includes, principally, Durham, Exeter, Newcastle and Reading.

The data yielded by the second stage investigation were in the form of dichotomies (decision to enter higher education before entry to sixth/after entry, application to college of education/no application) or, in the case of the constructs in trichotomies (positive pole applies/negative pole applies/neither pole applies). Correlations and multivariate analyses derived from them must, therefore, be approached with some caution, since there could be no strict adherence to the requirement of symmetrical distributions within and linear relationships between variables. What follows is, therefore, an attempt to provide some insights into the nature of data of a wide ranging character rather than to demonstrate exhaustively, and according to strict applications of probability measures, how such a complex field is structured.

Two variables were derived from the construct grids. Firstly, a distinction was made between subjects who placed a higher proportion of their chosen universities at the positive pole of a construct, and those who placed a higher proportion of those *not* chosen at the positive pole. This was treated as dichotomous variable. Secondly, a similar variable was formed by distinguishing those who placed a higher proportion of the universities they did not choose at the negative pole, from those who placed a higher proportion of chosen universities at the negative pole. Calculation of phi coefficients between the two sets of variables suggested two main conclusions.

(i) If the bipolarity of a construct is to be assessed on an operational basis, then B, C, D and E, as worded in the test, were quite highly bipolar and the others less so. It should be noted that it was not inherent in the form of the test that such a result should be found, since subjects were free to make use of the 'not applicable' response if they wished.

(ii) As all the correlations were positive, there was evidence of a general consistency over the subjects in the ways in which they saw the constructs as relating to one another. Constructs B, G and D clustered together as a set of core constructs; E, H and I were strongly related to this core; A and F were less strongly related to it, and C was only very loosely connected with the other constructs.

In the next stage of analysis, the construct variables were cross-tabulated with the actual university choices made by the subjects in an attempt to discover whether tendencies to choose or reject universities seen as having certain characteristics were associated with choices of particular universities, or types of university.

The calculation of measures of association using Goodman and Kruskal's G showed that some well-defined relationships existed between the manner in which the respondents located the universities on the constructs and their decisions on whether or not to apply to them. Those whose chosen universities were more likely to be seen as being at the *positive* pole of the construct tended to make the following decisions:

	Include among Choices	P	Exclude from Choices	P
A. Good provision for the study of my subject ...	Hull Nottingham	.01 .001		
B. Established Reputation	Birmingham ... Bristol Liverpool Manchester	.01 .01 .001 .01	New Universities	.01
C. Arts Bias	New Universities	.05	Manchester Ex-CATs.....	.05 .05
D. Old University.....	Bristol Liverpool Oxford/Cambridge/ London	.001 .01 .01	Ex-CATs.....	.01
E. Unattractive, industrial surroundings	Manchester Sheffield	.001 .05	Nottingham	.001
F. Compact buildings	Nottingham	.05	Oxford/Cambridge/ London	.05
G. Courses mainly traditional	Liverpool Sheffield	.05 .05	Ex-CATS	.001
H. Established redbrick ..	Liverpool	.05	New Universities	.01

I. Easy to enter	Liverpool		·01	Bristol		·05
	Welsh, Scottish,					
	Irish		·001			
	Ex-CATs		·01			

A similar, though not identical pattern of choices was found when the analysis was based on universities seen as being at the *negative* poles of the constructs:

		<i>Include among</i>			<i>Exclude from</i>	
		<i>Choices</i>		P	<i>Choices</i>	
A.	Not such good provision for my subject.....	Leicester	·001		Nottingham	·05
		Southampton ..	·05		Welsh/Scottish/ Irish	·05
B.	Reputation yet to be made	Leicester	·01		Bristol	·05
					Liverpool	·001
					Sheffield	·01
C.	Science Bias	Manchester	·05			
D.	New University				Bristol	·001
					Liverpool	·05
E.	Pleasant, non-industrial surroundings	Nottingham	·05		Leeds.....	·05
F.	Buildings spread out ..				Manchester	·01
					Hull	·05
					Nottingham	·05
G.	Courses with unique features				Bristol	·05
					Welsh/Scottish/ Irish	·01
H.	Snobbish or pretentious	Bristol	·05			
I.	Hard to enter	Bristol	·001		Ex-CATs.....	·01
		New Universities	·05			

The question remained, however, of the relative importance to be assigned to perceptions of universities, as evidenced by the data on constructs, and to environmental factors, in describing how these choices came to be made. It was also important to make some enquiry into the nature and extent of the interaction between the two sets of variables.

A further stage in data analysis was therefore undertaken in which the biographical and educational data were put together with the construct items and the data on choice of university in a single correlation matrix and a factor analysis carried out. Seven factors, accounting for 48·7 per cent of variance were retained from the principal components solution and subjected to a varimax rotation.

Factor I (12·5 per cent of variance) might be described as a "Core Construct" factor, since the heaviest loadings were found on the variables relating to constructs B, D and G. Loadings of 0·30 or above were found for all other construct items, and also for desire for an Arts based course and choice of a new university. The factor was otherwise unrelated to items not concerned with constructs.

Factor II (9·2 per cent) was a bipolar Arts/Science factor, which, as might be expected, also attracted loadings on sex and application for a college of education. It was associated with choice of the University of Hull, and rejection of the ex-CATs. A small loading was found on the positive pole of construct C, Arts/Science bias, but apart from this the factor was independent of the construct items.

Factor III (6.6 per cent) had its heaviest loading on choice of universities at the negative pole of construct I—'difficult to enter.' The universities to which it was clearly and strongly related were Bristol and the group consisting of Oxford, Cambridge and London. It could be regarded as a 'social class' factor since it attracted high loadings on education of both parents beyond the age of 16, but it could equally well be interpreted as a 'confidence' or 'prestige' factor. Other significant loadings were on early decision to apply for a university place, desire for a specialist university course, rejection of ex-CATs, and perception of chosen universities as being 'spread out' (probably in the sense of collegiate rather than campus), but *not* new and *not* having better provision for the subject to be studied. This last relationship seems contradictory, unless it is to be explained by the fact that although specialist courses, and universities which are seen as 'difficult to enter' are chosen for considerations of prestige, applicants realise that, on an objective evaluation, other universities and courses may offer teaching which is at least as good, and possibly better.

Factor IV (5.7 per cent) was defined by loadings on construct E, industrial-non-industrial, which were higher than those attracted to Factor I, and related to rejection of universities seen as having 'pleasant, non-industrial surroundings' and choice of those perceived as having the opposite characteristic. Manchester and the ex-CATs were chosen; Nottingham and Birmingham rejected. There were loadings on high certainty (i.e., little use of the neutral response category) for the rejected universities and on use of a preference code of 0-2, that is, the expression of few positive choices. There was also a high loading on having brothers or sisters who had followed, or were following, a course of higher education, and a smaller one on choice of a college of education, but no loadings on sex or parents' education. This might be described as a 'Commitment to reality—rejection of pretension' factor (there is a loading on rejection of universities seen as 'snobbish or pretentious').

Factors V to VII, accounting for 5.1, 4.8 and 4.7 per cent of variance, respectively, were highly specific and not interpretable.

DISCUSSION

The analyses suggest that some aspects of the image which is held of a particular university help to decide whether or not it is chosen by applicants. The nature of Factor I, however, indicates that the university 'image' to which the applicant responds is presumably something 'given' rather than something which, since it is constructed from his own experience, is highly dependent on his own personal history and circumstances. The linkage with personal variables occurs through the more peripheral constructs, as can be seen from a scrutiny of Factors II, III and IV (though the relationship of the Arts/Science factor to the corresponding construct is quite weak).

Such an observation is consonant with the thesis that 'there is a distinctive English idea of a university' and it is interesting that certain of the points stressed by Halsey and Trow in their recent analysis of 'the English idea,' such as antiquity, selectivity and the small residential community are echoed, explicitly or implicitly, in the constructs produced by the sixth formers (Halsey and Trow, 1971). It is a feature of 'images' or 'stereotypes' that they are persistent and not readily modifiable through exposure to rational information (Boulding, 1956; Clark, 1960). It is, therefore, pertinent to enquire what stresses may be set up and what difficulties created in the minds of students who must face up to the problem of entry to higher education while heavily influenced by stereotypes which are being ever more rapidly outstripped by reality. Much attention has been given recently, particularly in the United States, to the

information problem created by a situation in which a wide variety of students are seeking entry to a multiplicity of institutions, and stress has been laid on the necessity for 'symmetry' in the flow of information—that is, that students should be in possession of as much knowledge about institutions as institutions have about students (Coleman, 1970). However, the present research draws attention to the fact that merely increasing the quantity or quality of information available to candidates is not enough: it is important to have a better understanding of the perceptions of the receivers (and, for that matter, of the transmitters) of information, of the development of these perceptions over time and of the extent to which selection for universities is, in effect, self-selection based upon responses to popularly accepted stereotypes. Repertory grid techniques applied on a group basis may provide one useful method of making a beginning in this complex field of enquiry.

ACKNOWLEDGMENTS—Valuable assistance in the collection and analysis of the research data was given by Mrs. Susan Insch, Mrs. Anne Orton and Mr. John Mallatratt of the Birmingham Teaching Research Unit.

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(Manuscript received 21st July, 1971)

RESEARCH NOTES

A SEMANTIC DIFFERENTIAL COMPARISON OF CERTAIN ATTITUDES OF UNIVERSITY STUDENTS FROM CO-EDUCATIONAL AND SINGLE-SEX SCHOOL TOWARDS THEIR SCHOOLS*

By R. R. DALE AND P. McC. MILLER
(University College of Swansea)

SUMMARY. Scores on the 'evaluation,' 'potency' and 'activity' of four concepts concerning school and four about the university were obtained from a Semantic Differential test completed by 274 first-year university students. The women from girls' schools tended to evaluate 'my school' and 'school teacher' lower than did the co-educated women ($P < 0.1$ and 0.2 , respectively). On the Pleasant/Unpleasant scale within the evaluation of 'my school' both co-educated men and women rated their schools as more pleasant than did men and women from single-sex schools ($P < 0.05$).

Co-educated students rated 'school,' 'teacher,' and 'classroom' as significantly less potent than did those from single-sex schools. The latter saw 'university' as less potent than 'my school' ($P < 0.01$), 'lecture-theatre' less than 'classroom' ($P < 0.05$), while the co-educated did not.

INTRODUCTION

Recent research suggests that there is an appreciable difference in atmosphere between co-educational and single-sex secondary schools (Dale, 1969, 1971). For example, single-sex schools seem, on average, to be stricter in discipline, rather less happy and to have less pleasant relationships amongst the staff and between staff and pupils. To extend the exploration of this field the semantic differential technique developed by Osgood, Suci and Tannenbaum (1957), and recently reviewed by Heise (1969), was employed. Students rated *concepts*, such as 'my school,' on a series of seven-point scales the poles of which were defined by pairs of adjectives such as good/bad, hard/soft, etc. Any such scale loads on one of three different and independent *factors* labelled by Osgood *et al.* (1957) 'evaluation,' 'potency' and 'activity.'

THE SAMPLE

The sample consisted of 145 male and 129 female students from the 1968-69 and 1969-70 first-year classes at the University College of Swansea. It was limited to the 316 students in the Faculties of Arts and Pure Science who had sat the W.J.E.C. A-level examination and were taking at least one of the following subjects: French, History, Geography, Applied Mathematics, Pure Mathematics, Physics, Chemistry and Botany, but there were 24 non-co-operators and 18 who had attended both types of school were eliminated.

PROCEDURE

In the second and third weeks of the winter term the students were asked to co-operate in a large survey, of which the semantic differential test formed a part. They were usually tested in large groups, but occasionally individually. Nine concepts were used of which four related to the subject of this article. The four were: 'my school,' 'school teacher,' 'my class at school' and 'classroom.' Occasional reference will be made to four university concepts with which they were paired. Each concept was rated on 11 seven-point scales, five of these loading on evaluation, and three each on potency and activity. The rating scales and method of scoring used are detailed in the appendix.

METHOD OF ANALYSIS

Before calculating the mean differences between the principal groups on the evaluation, potency and activity of the various concepts, a number of unwanted

* Part of a project assisted by the S.S.R.C.

variables were controlled. For the A-level attainment, faculty and social class variables this was done by choosing from the main group a special 'balanced' sample. All the subcells of this sample contained nearly equal proportions of students from the two faculties, from four categories of A-level attainment and from the various social classes. As there were no single-sex educated students in the lowest of the A-level categories the sample was drawn from the top three categories only, to preserve proportionality. This reduced the balanced sample to 104. The remaining 170, however, except for 18 randomly eliminated for procedure by analysis of variance, were used as a cross validation sample (termed the *remainder sample*). Results for both samples are reported but it is to be remembered that the two are by no means equivalent in composition.

Those extraneous variables which could not be balanced out from *either* sample, notably the urban/rural variable, were dealt with by a separate examination involving comparisons, within each basic cell (e.g., within the co-educated males' cell) of the mean concept ratings for e.g., urban and rural students. For the four school concepts no systematic differences associated with these unwanted variables could be found. The results for the balanced and remainder samples were similar, suggesting that the extraneous variables have relatively little effect. Accordingly, the two samples were later pooled and further analyses run on the combined data.

After assessing the effects of the extraneous variables, three-way analyses of variance, using procedures described in Kirk (1968, p. 283 ff.) were run on the evaluation, potency and activity scores. The variables thus analysed were sex, co-educational school/single-sex school, and school concept/university concept.

RESULTS AND DISCUSSION

Tables 1 and 2 show the mean evaluation and potency ratings for the concepts. The activity ratings are not reported here, as they yielded no consistent differences between co-educated and single-sex educated students.

TABLE 1
SEMANTIC DIFFERENTIAL—MEAN EVALUATION RATINGS (Range 5-35).

Concept	Balanced Sample		Remainder Sample		Combined Samples	
	26 Men 26	26 Wom. 26	42 Men 34	42 Wom. 34	68 Men 60	68 Wom. 60
	Co-edS/sex	Co-edS/sex	Co-edS/sex	Co-edS/sex	Co-edS/sex	Co-edS/sex
My school ...	28.2 29.2	29.5 27.7	27.5 26.8 (28.4)	29.4 27.5 (27.5)	27.8 27.8 (28.3)	29.4 27.6 (27.6)
This university college	28.9 31.0	30.9 32.6	29.4 30.1 (29.8)	31.0 30.9 (31.0)	29.2 30.5 (29.5)	30.9 31.6 (31.7)
School teacher	28.5 29.5	29.4 28.2	27.2 28.2 (27.9)	29.5 27.9 (28.0)	27.7 28.8 (28.1)	29.4 28.0 (28.1)
University lecturer ..	27.5 28.8	28.0 28.9	26.8 27.8 (26.7)	28.6 27.6 (27.7)	27.0 28.2 (26.9)	28.3 28.2 (28.2)
My class at school	28.2 28.4	29.7 29.7	27.8 26.6 (28.3)	29.7 29.8 (29.9)	28.0 27.4 (28.3)	29.7 29.8 (29.8)
Student	27.3 29.0	28.9 30.2	26.9 28.2 (27.2)	28.9 29.5 (29.7)	27.1 28.6 (27.2)	28.9 29.8 (29.9)
Classroom ..	24.2 25.2	25.0 25.5	23.7 24.0 (24.7)	25.9 27.2 (27.1)	23.9 24.5 (24.6)	25.5 26.5 (26.4)
Lecture theatre ...	24.8 23.2	24.7 26.5	25.3 25.8 (25.2)	26.1 27.0 (27.1)	25.1 24.6 (25.1)	25.6 26.8 (26.9)

Figures in parentheses are means before random elimination of 18 students for procedure by analysis of variance.

TABLE 2
SEMANTIC DIFFERENTIAL—MEAN POTENCY RATINGS (Range 3-21).

Concept	Balanced Sample		Remainder Sample		Combined Samples	
	26 Men 26	26 Wom. 26	42 Men 34	42 Wom. 34	68 Men 60	68 Wom. 60
	Co-ed S/sex	Co-ed S/sex	Co-ed S/sex	Co-ed S/sex	Co-ed S/sex	Co-ed S/sex
My school ...	11.9 14.4	13.2 14.0	11.2 12.5 (11.7)	12.0 13.4 (13.2)	11.4 13.3 (11.8)	12.5 13.7 (13.5)
This university college	12.1 12.0	12.9 13.0	12.0 11.6 (12.2)	13.4 13.0 (13.0)	12.1 11.8 (12.2)	13.2 13.0 (13.0)
School teacher	12.8 14.3	13.6 14.2	12.1 13.3 (12.7)	13.4 13.5 (13.6)	12.4 13.7 (12.7)	13.5 13.8 (13.8)
University lecturer	11.6 11.9	12.0 12.9	11.3 10.8 (11.4)	12.4 12.8 (12.8)	11.4 11.3 (11.5)	12.3 12.8 (12.8)
My class at school	12.7 13.6	12.5 13.5	12.5 12.5 (12.6)	12.7 12.5 (12.5)	12.6 13.0 (12.7)	12.6 12.9 (12.9)
Student	12.5 13.2	13.1 14.4	12.2 12.1 (12.4)	13.1 13.0 (13.1)	12.3 12.6 (12.5)	13.1 13.6 (13.6)
Classroom ..	12.2 13.4	13.2 13.3	12.2 12.9 (12.4)	12.6 13.4 (13.3)	12.2 13.1 (12.3)	12.8 13.4 (13.3)
Lecture theatre ...	12.3 11.3	12.1 12.7	12.6 11.7 (12.8)	13.0 12.5 (12.4)	12.5 11.5 (12.7)	12.6 12.6 (12.6)

Figures in parentheses are means before random elimination of 18 students for procedure by analysis of variance.

The data show that there may be a tendency for women to rate almost all the concepts more highly than men do (cf. Heise, 1969). This occurred in 45 out of the 54 possible comparisons of the type 'co-educated women against co-educated men,' and when the co-educated and single-sex educated groups are combined the difference between men and women reaches significance in 13 cases out of 27. This effect is examined more fully elsewhere but is pertinent here because two exceptions to this trend are of considerable interest; they arise from the mean evaluation ratings of 'my school' and 'school teacher.' Examination of the data for these two concepts reveals that the *co-educated women* conform to the usual trend by giving higher evaluations than the co-educated men, but there is a reverse effect among those educated in single-sex schools, the women giving lower evaluations than the men, especially in the more dependable balanced sample. Furthermore, the evaluations of 'my school' and 'school teacher' are lower for the women from girls' schools than for the corresponding co-educated women ($P < 0.1$ and $P < 0.2$, respectively). These evaluations by those from girls' schools are therefore lower than one would expect from a general appraisal of the data and are in line with Dale's findings (1969 and 1971) about the less happy atmosphere in some single-sex schools compared with co-educational.

For the men's groups there is virtual equality between the co-educated and the single-sex educated on the evaluation of 'my school,' and a non-significantly higher evaluation among those from boys' schools on 'school teacher.' The present 'evaluation' score, however, for both men and women contains elements not included in Dale's earlier research on happiness and school atmosphere. For example, 'my school' is here evaluated on an amalgam of scores from the scales Pleasant/Unpleasant, Trivial/Important, Negative/Positive, Valuable/Worthless

and Good/Bad, and it is quite possible for a school to be evaluated highly because owing to its age and tradition it is an 'Important' and maybe 'Valuable' school, though its score on 'Pleasantness' may be only average.

When the two scales Pleasant/Unpleasant and Important/Trivial were analysed separately it was found, as expected, that on 'pleasantness of school' the co-educated men gave the higher scores in both balanced and remainder samples. The same holds for the women, the differences between the combined samples being significant ($P < 0.05$). On Important/Trivial there were no significant differences.

The same type of procedure was used for 'school teacher,' again producing higher scores on Pleasant/Unpleasant for the co-educated men (slight) and co-educated women ($P < 0.05$) as against the same groups from single-sex schools, while on Important/Trivial the co-educated men tended to rate 'school teacher' lower than did men from boys' schools and the co-educated women *vice versa* (both not significantly).

An evaluation result which involves comparison of school and university concepts is that the single-sex educated are more favourable to university as *compared to school* than are the co-educated ($P < 0.05$). A possible explanation is that the relaxation from the greater discipline of the single-sex schools coupled with the better opportunity to meet and mix with the opposite sex could be responsible. The latter circumstances may also explain the higher evaluations of 'student' by the single-sex educated ($P < 0.05$ in the combined samples). Similarly it is interesting that the co-educated seem to evaluate 'student' less highly than 'my class at school' while the reverse holds for the single-sex educated ($P < 0.1$ for the combined effect).

It is on the potency factor that the most striking results are to be seen and here there is strong indirect support for previous findings relating to the stricter discipline in single-sex schools. It would be expected that students from such schools would tend to rate them as more 'potent,' i.e., more severe, hard and strong than the co-educated students would rate their schools. This is, in fact, what we find. On three of the four school concepts the single-sex educated give higher mean potency ratings than the co-educated do, and, particularly on 'my school,' the effects reach a high level of significance ($P < 0.001$). The difference is in the same direction for the fourth concept 'my class at school,' but is not statistically significant. There is however, little evidence of any 'carry over' of these potency differences into university and its related concepts. Indeed, the single-sex educated see 'this university college' and 'lecture theatre' as less potent than 'my school' and 'classroom' respectively. This does not hold amongst the co-educated ($P < 0.01$ and $P < 0.05$).

Since the same students rated both the school and university concepts, these results suggest that the potency findings on the school concepts are not likely to be due to differing response styles within the two groups, i.e., it is established that the single-sex educated students clearly do not tend to rate *all* concepts as more potent than do the co-educated students.

It is of some interest that the higher ratings of school on *potency* by the single-sex educated do not extend to the *activity*, or to the *evaluation* of school. It may be that an essential difference between the two types of school lies in the greater strictness that appears to obtain in single-sex schools. This need not, and apparently does not lead to lesser *evaluations* of school by the single-sex educated, although, as we have seen both here and in previous research, the single-sex educated pupil does appear to regard his school as less *pleasant* than does his counterpart in the co-educational institution.

The question of whether the differing impact of the two types of institution continues its effects after school (cf. Atherton, 1970, on co-education and happiness in marriage) is under active consideration in the present project on first-year students at university.

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(Manuscript received 26th March, 1971)

APPENDIX

Code Number... ..

Concept: MY SCHOOL

Pleasant	Unpleasant (E)
Passive	Active (A)
Trivial	Important (E)
Severe	Lenient (P)
Sharp	Dull (A)
Weak	Strong (P)
Negative	Positive (E)
Hard	Soft (P)
Valuable	Worthless (E)
Slow	Fast (A)
Good	Bad (E)

The scoring on each side is weighted from 1-7 according to the adjectives constituting its extremes.

The score on the *Evaluation* factor is the sum of the scores on the items marked (E) above. Similarly for *Potency*, where items are marked (P) and *Activity*, where items are marked (A).

These three factor scores were obtained for each of the nine concepts, 'my school,' 'school teacher,' etc.

EXPRESSED ACHIEVEMENT MOTIVATION IN RELATION TO THE ACHIEVEMENT MOTIVE, NEUROTICISM AND SCHOOL SUCCESS

By D. S. FINLAYSON

(School of Education, Liverpool University)

SUMMARY. The relationship of two motivational measures, *n*/achievement and neuroticism, with expressed achievement motivation was examined in groups of successful and unsuccessful secondary school boys in a three-way analysis of variance. When the expressed motivation was of a fantasy nature it was found to be associated with neuroticism in both groups, but when real-life items were used to elicit it, the direction of the relationship with *n*/achievement and neuroticism was contrary in the successful and unsuccessful groups. Among the successful there was an increasing drop in achievement motivation from the consistently high *n*/achievement and neuroticism groups through the inconsistent groups (high *n*/achievement low neuroticism, low *n*/achievement, high neuroticism) to the consistently low *n*/achievement and neuroticism groups while amongst the unsuccessful groups there was a corresponding rise. This result in the unsuccessful group was interpreted as a resolution of the conflict they experienced between normative expectations for success and information about their actual performance.

INTRODUCTION

A formulation which is well substantiated in the literature (McClelland, 1958; Atkinson and Litwin, 1960) is that assessments of motivation deriving from projective and questionnaire methods are unrelated. As a consequence, McClelland considers the constructs measured by these two methods to be basically different: that measured by projective methods which he calls need for achievement or *n*/achievement, he regards as an internalised motive or need, while that measured by questionnaire methods, expressed achievement or *v*/achievement, he regards as being open to the influence of social desirability and acquiescence factors and also likely to reflect the way in which the subject has learned to view himself in relation to reality.

From this last formulation, it seems a reasonable hypothesis, because of information which children derive about their progress in school and hence about themselves in relation to reality, that their expressed achievement would be affected by the degree of their success or unsuccess in academic work. According to this argument, expressed achievement motivation is akin to persistence or striving behaviour in Atkinson's theory of motivation (Feather, 1961, 1963). In that theory, such behaviour is held to alter according to changes occurring in the expectations of success which individuals have as a result of the feed-back of information about their performance. The manner in which persistence would change, according to Atkinson, would be determined by the relative strengths of their approach and avoidance motives.

In this paper a measure of success in school in which ability is controlled is related to expressed achievement, bearing in mind the possible influence of two motivational factors. The first of these was a measure of *n*/achievement and the second neuroticism. The former can be regarded as indicating positive achievement orientation while the latter has been conceptualised as reflecting the general level of 'arousal' (Frost, 1968) or 'drive' (Furneaux, 1962) which a subject has.

Accordingly success, *n*/achievement and neuroticism were given independent status as factors in a three-way analysis of variance design having as the dependent variable a measure of expressed achievement.

METHOD

As part of a larger project conducted with boys in the academic classes of three secondary schools two groups of pupils were selected, one successful ($N=68$) and the other unsuccessful ($N=72$). This was done by using the combined 11+ quotient scores in Verbal Reasoning, English and Arithmetic tests, and scaled teachers' estimates of the sample school population ($N=316$) to predict, by means of regression equations, their attainment in the first, second and third year school examinations. Their actual examination attainments, assessed by summing the standardised marks

obtained in the main school subjects, were then compared with their predicted attainment. Where these either exceeded or fell below the predicted level by more than the probable error over the three examinations, the boys were categorised as successful or unsuccessful respectively. By using this regression method, the possibility that subsequent differences between the groups might be associated with differences in ability is eliminated.

The measure of *n*/achievement was derived from the responses of the sample to four pictures selected from the list given in McClelland (1958). Slides of these were projected to classroom groups of boys for 30 seconds under neutral conditions. Responses were scored using a modified version of McClelland's system (McClelland, 1953). The distribution of scores tended to be skewed, with low scores predominating. Neuroticism was measured by scoring the appropriate items of the JEPI (Eysenck, 1965).

Two questionnaire measures of expressed motivation were used. The first, one of fantasy achievement, was a modified version of Stern's scale (Stern, 1963), the items of which are considered by Stern as representing daydreams of extraordinary public recognition. Hence, they can be regarded as expressions of a desire to seek recognition, not in reality situations in which failure is always a possibility but in a fantasy world where no such possibility exists. The second was a reality-based measure of achievement motivation in which the items described patterns of striving and persistent behaviour in achievement-orientated situations. Some were inspired by Stern's achievement scale and adapted for an English context while others were original. Positive and negative items were included to reduce response set and, after item analysis of each set of items, Kuder Richardson reliability figures of .82 and .69 respectively, were obtained.

The measures of *n*/achievement and neuroticism were taken early in the boys' second year at the school, those of fantasy achievement and expressed motivation at the end of the third year, and that of success or unsuccess was cumulative over the three years.

A median split was made in the neuroticism and *n*/achievement distribution of scores for both the successful and unsuccessful groups. Thus for both successful and unsuccessful boys four groups were obtained (high neuroticism—high *n*/achievement, high neuroticism—low *n*/achievement, low neuroticism—high *n*/achievement, low neuroticism—low *n*/achievement) and the numbers in each cell of the analysis of variance design ($N=17$) were equalised by random selection. The total number of boys in the study is thus 136.

RESULTS

Table 1 shows the mean fantasy achievement scores of the successful and unsuccessful groups. There is a consistent tendency for boys with low *n*/achievement to prefer recognition associated with unrealistic daydreams and for the high neuroticism groups to make similar preferences. The *F* ratios for each of the effects are shown in Table 2 but only the neuroticism effect reaches significance. Whether a boy is successful or not in his school has no effect on his fantasy preferences. None of the interaction effects is significant either. These findings suggest that preferences for achievement in fantasy situations are perhaps best regarded as a reflection of a fairly stable personality characteristic that does not appear to be influenced by real experience of achievement.

TABLE 1
MEAN FANTASY ACHIEVEMENT SCORES OF SUCCESSFUL AND UNSUCCESSFUL GROUPS.

Groups		Successful		Unsuccessful	
Neuroticism		High	Low	High	Low
<i>N</i> /achievement	High	4.47	3.47	5.06	2.94
	Low	5.53	4.00	5.65	4.06

TABLE 2

ANALYSIS OF VARIANCE TABLE FOR FANTASY ACHIEVEMENT SCORES.

Source	d.f.	Sum Sq.	Mean Sum Sq.	F. ratio
Neuroticism (N)	1	82.62	82.62	9.50**
N/achievement (N/ach) ..	1	23.06	23.06	2.65
Success (S)	1	0.12	0.12	<1
N × N/ach	1	0.00	0.00	<1
N × S	1	2.94	2.94	<1
N/ach × S	1	0.03	0.03	<1
N × N/ach × S	1	2.38	2.38	<1
Within groups	128	1121.41	8.70	<1
Total	135	1232.56		

** $P = < .01$

Table 3 shows the achievement motivation scores of the successful and unsuccessful groups, and it can be seen that the direction of the relationship of the n/achievement and neuroticism effects with expressed motivation is contrary in the two groups. Hence, in Table 4, none of the major effects is significant but the contrary trends give rise to significant interactions between success on the one hand and n/achievement and neuroticism on the other hand.

TABLE 3

MEAN ACHIEVEMENT MOTIVATION SCORES OF THE SUCCESSFUL AND UNSUCCESSFUL GROUPS.

Groups		Successful		Unsuccessful	
Neuroticism		High	Low	High	Low
N/achievement	High	11.18	10.88	7.53	9.35
	Low	10.41	7.71	8.41	11.12

TABLE 4

ANALYSIS OF VARIANCE TABLE FOR ACHIEVEMENT MOTIVATION SCORES.

Source	df	Sum Sq.	Mean Sum Sq.	F ratio
Neuroticism	1	4.97	4.97	<1
N/achievement (N/ach) ..	1	3.55	3.55	<1
Success	1	30.11	30.11	2.73
N × N/ach	1	4.98	4.98	<1
N × S	1	120.47	120.47	10.92**
N/ach × S	1	92.25	92.25	8.36**
N × N/ach × S	1	23.05	23.05	2.09
Within groups	128	1411.88	11.03	
Total	135	1691.26		

** $P = < .01$

These findings thus confirm the already reported lack of relationship between *n*/achievement and expressed motivation when the data from the whole sample are considered. If, however, success and unsuccess in school is introduced as a moderating variable a pattern of relationship becomes clear. Boys who are achievement motivated and who are successful have high expressed motivation while those who are achievement motivated and who are unsuccessful have low expressed motivation. The same can be said of boys who have high neuroticism scores. The converse is the case with boys low in achievement motivation and neuroticism.

TABLE 5

'INCONSISTENT' GROUP MEANS.

Inconsistent Groups	Successful	Unsuccessful
High <i>n</i> /ach Low neuroticism	10.88	9.35
Low <i>n</i> /ach High neuroticism	10.41	8.41

In addition to throwing light on the nature of the relationships between *n*/achievement and achievement motivation, these findings also illuminate the roles which *n*/achievement and neuroticism play in the relationship between successful performance in school and expressed achievement. This role is more clearly demonstrated if the data from the four cells in which the effects of *n*/achievement and neuroticism are inconsistent are taken by themselves (i.e., boys who are achievement motivated but have low levels of arousal and conversely those who have high levels of arousal but are not achievement orientated). A two-way analysis of variance of those cells shown in Table 5 indicates that, while success was significantly related to achievement motivation at the 5 per cent level ($F=4.73$), successful boys expressing higher achievement motivation than unsuccessful boys, the difference between the two inconsistent sets of groups was not significant ($F<1$). Because the influence of the inconsistent combination of *n*/achievement and neuroticism are similar, the data from these cells can be combined across rows. As a result of this combination, a very much clearer picture is presented in Table 6. Amongst the successful groups there is a progressively increasing drop in achievement motivation as one moves from the consistently high *n*/achievement and neuroticism groups through the inconsistent groups to the consistently low *n*/achievement and neuroticism groups. Amongst the unsuccessful groups there is a corresponding increasing rise.

TABLE 6

MEAN ACHIEVEMENT MOTIVATION SCORES OF CONSISTENTLY AND INCONSISTENTLY MOTIVATED GROUPS.

Level of success	High <i>n</i> /achievement and neuroticism	Inconsistent <i>n</i> /achievement and neuroticism	Low <i>n</i> /achievement and neuroticism
Successful	11.18	10.65	7.53
Unsuccessful	7.71	8.88	11.12

DISCUSSION

Bearing in mind the size and relative homogeneity of the sample, a number of points seem to warrant discussion in the light of these findings. The first relates to the difference of effect of success experience in school on expressed motivation according to whether fantasy or real achievement motivation is being assessed. Such experience has no relationship with the former and a complex relationship with the latter according to the level and consistency of the effects of neuroticism and $n/achievement$.

The second point concerns a possible explanation of why projective and questionnaire measures of achievement motivation have tended to be unrelated in educational studies. The findings suggest that the level of success reached in school is a crucial moderating variable to include in the research design. If success is interpreted as the source of feed-back to the subject, then to have information about whether one has done well or not so well would appear to determine how one expresses one's achievement motivation. Information about success can be regarded as confirming the achievement norms likely to predominate in the academic classes of school and unsuccessful as disconfirmatory information about such expectation. If this view is accepted then a feasible explanation of the findings can be offered. With successful boys, the achievement motivation exactly reflects the motivation or drive of the subjects as these are assessed by the $n/achievement$ and neuroticism measures. It thus makes explicit their level of achievement or drive. With unsuccessful boys, where achievement expectations are not confirmed, the conflict between their performance and the normative expectations associated with the school may make these pupils aware of their 'unsatisfactory' progress. If the 'unsatisfactory' outcome occurred with motivated and high drive pupils they expressly denied their motivation, a response that could be interpreted as a rationalisation of their unsuccess. If the pupils had low motivation and low drive, then they expressed high levels of striving, a response that might reflect unrealistic wish-fulfilling tendencies. Such an interpretation of the findings with the unsuccessful boys goes far beyond the evidence presented in this paper but, because it is in line with the earlier findings of Sears about levels of aspiration of unsuccessful children (Sears, 1940) it would appear to be worthy of empirical test.

A further point can be made about conceptualising success as a source of feed-back about performance to the subjects. As such it has been accorded independent status in relation to achievement motivation. Such a role is in marked contrast to those studies in which expressed achievement motivation is given a predictive role in relation to achievement (Entwistle, 1968; Nisbet and Entwistle, 1966; Finger and Schlessor, 1965). To treat it as a predictor perhaps implies a causal relationship between it and achievement. It may well have such a status, but in any comprehensive treatment of the relationship between the two variables it would appear that there is a need to adopt a process-orientated view of school achievement. In such a view the feed-back of information about performance would be given an important place and hence perhaps act as a corrective to an over-concern with prediction in education. As has been suggested elsewhere (Finlayson, 1971) such over-concern can lead to the neglect of dynamic modes of thinking and serious errors in drawing conclusions. In a dynamic conceptual model, room would require to be found for the study of two-way cause and effect relationships between expressed achievement and actual achievement. This paper has demonstrated that the degree of success experienced by pupils has an effect on their expressed motivation according to pattern of their motivational characteristics. Expressed motivation may, in its turn, have consequence for subsequent success, but in order that this relationship could be tested, a design which controlled for the effects of the two motivational variables $n/achievement$ and neuroticism would require to be used. The fact that the evidence from studies relating these two variables independently to achievement is inclusive does not weaken the strength of the argument for it may be that the research designs to test these relationships have been over-simple and that important interaction variables have been omitted (Entwistle and Wilson, 1970). This last point has obvious methodological implications for it is clear, as Lavin suggests (Lavin, 1965) that multifactorial research designs rather than simple

correlational ones require to be employed if the complex role of personality and motivational factors in school achievement is to be explored adequately.

ACKNOWLEDGMENT—The author gratefully acknowledges the help of Dr. W. P. Robinson, University of Hull, in connection with the collection of the n/achievement data. All the data for this paper were collected as part of a larger project financed by the Department of Education and Science.

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(Manuscript received 2nd April. 1971)

THE INFLUENCE OF SEX, ACHIEVEMENT LEVEL AND SOCIAL CLASS ON JUNIOR SCHOOL CHILDREN'S ATTITUDES

By JOAN C. BARKER LUNN

(National Foundation for Educational Research, Slough, Bucks).

SUMMARY. Attitude scales measuring various aspects of school life were presented to approximately 2,000 junior school children. Clear sex differences appeared in the attitude scores: girls tended to have more favourable school-related attitudes, boys tended to have a better academic self-image, to be better socially adjusted and to be less anxious in the classroom situation. In all attitude areas, brighter children tended to have more positive attitudes; also the tendency for more favourable attitudes was found for middle class children in contrast to those from working-class homes. The findings did, however, suggest that the different attitudes of pupils of different social classes could partly be accounted for by their differences in academic performance, but this was not the full explanation.

INTRODUCTION

A previous paper (Barker Lunn, 1969) described the development of 10 attitude scales to measure junior school children's attitudes. These scales were derived empirically: each was made up of a number of statements made by children during group discussions and selected after factor analyses and scalogram analyses. The intercorrelations of the scales with each other and also with certain external data were given.

Further analyses of the original sample have now been carried out and an attempt made to examine the influence of sex, achievement level and social class on pupils' attitudes. These results are considered in relation to other published findings.

PROCEDURE

Approximately 2,000 third and fourth-year junior school children completed the attitude questionnaire. Twenty-eight primary schools were involved and these were located throughout England. Details of the sample, questionnaire and administration can be seen elsewhere (Barker Lunn, 1969, 1970).

Ten attitude areas were investigated. Six of these concerned school-related attitudes—these were: (a) attitude to school; (b) interest in school work; (c) importance of doing well; (d) attitude to class; (e) other image of class; (f) conforming *versus* non-conforming. The other four were concerned with the pupils' personality and social relationships; these were (g) teacher relationship; (h) academic self image; (i) anxiety; (j) social adjustment. The attitude scores were examined in relation to sex, achievement level and social class. Achievement level was based on the child's score on an English test: three groups of equal size were formed: (i) above average; (ii) average and (iii) below average (see Barker Lunn 1970). For the analysis by social class three groups also were formed: (i) middle class (professional and clerical); (ii) upper working class (skilled) and (iii) lower working class (semi-skilled and unskilled). This information was obtained from the class teacher's rating of each pupil's father's occupation according to the Registrar-General's groupings (for further information, see Barker Lunn, 1970). In the analyses by achievement level and social class, separate comparisons were carried out for boys and girls.

RESULTS

Sex.

It was found that on the school-related attitude scales girls had significantly more favourable attitudes than boys ($P < .001$), whereas on the scales concerned with personality and social relationships boys had more favourable attitudes ($P < .001$). The only exception was on the teacher-relationship scale.

More girls *liked school* and fewer disliked it. Girls also expressed more *interest in school work* and placed more *importance on doing well in school*. They were more *class-involved* or satisfied with being a member of a particular school class. Also girls had a better '*other image*' of their class;* whether or not the school was streamed was an important factor here, and the difference between the sexes could perhaps have been partly due to the tendency for more boys than girls to be in the lower ability streams (for the effects of streaming on '*other image*' of class, see Barker Lunn, 1970). Finally, girls were more *conforming* than boys.

On the other four attitude scales, concerned with personality and social relationships, the sex trend was reversed. Girls had more negative feelings than boys: they had a poorer *academic self-image*, they were more *anxious* in the class room and were less *socially adjusted*. On the remaining scale, *relationship with teacher*, which dealt with the teacher's degree of concern for the child (as perceived by the child), girls obtained better scores. Although this was so, only one in 20 of either sex obtained the maximum score.

* The '*other image*' of class scale was concerned with the way a pupil believed other classes in the school viewed his class.

It is worth noting here how these findings tied in with what the teachers themselves felt. Did they prefer girls to boys? The class teacher rated each child on a four-point scale indicating how great a pleasure it was to have him in the class; these ratings were then analysed according to the pupil's sex and perceived ability (as rated by the teacher on a five-point scale). The results confirmed the children's own beliefs: teachers tended to find girls more of a pleasure than boys ($P < .001$) and brighter children more pleasurable than duller ones ($P < .001$). Further details of this study can be found elsewhere (Barker Lunn, 1970).

The findings concerned with sex differences on the whole agree with other published work, although most of these studies have been restricted to measuring general attitudes to school and teacher (Fitt, 1956; Fox *et al.*, 1964; Sears, 1963). Other workers (Fitt, 1956; Tenenbaum, 1944; Wisenthall, 1965) noting that girls liked school better than boys have generally laid it down to the belief that girls are more conforming and more amenable to discipline and order than boys. Girls at the primary school level make faster progress and attain a higher level of achievement and this could be another reason for their greater satisfaction than boys. Together these make a plausible explanation for girls' superior school-related attitudes. But given better school-related attitudes why should they be more anxious in class, have a poorer academic self image and poorer social adjustment? It is suggested that by having superior school-related attitudes, girls are more involved both with their school and teacher and aim to please: thus they feel more anxious, set themselves a higher standard and judge themselves more harshly than boys.

Achievement level.

Children of above average achievement had more positive attitudes than less able children. This relationship went beyond the 1 per cent level of statistical significance on all the attitude scales, except on the conforming *versus* non-conforming scale (boys $P < .01$; girls $P < .05$) and for boys on the teacher relationship scale ($P < .05$).

Studies of the relationship between attitudes to school and achievement have consistently obtained significant findings. For example, Jordan (1941), Arvidson (1956), Wall *et al.* (1963), Shinn (1956), McGauvran (1955) and others have reported studies in which pupil attitudes were significantly related to academic success. The finding that the more able child has superior attitudes is not surprising—this type of child achieves more academically and thus to a certain extent one might expect him to obtain greater satisfaction. In one sense, he has less to be anxious about and his academic self-image certainly should be better than that of his less able peers. Also it is known from sociometric studies (Buswell, 1953; Heber, 1956) that the brighter child is more popular, partly perhaps because of his greater self-confidence, and it could well be that his greater popularity contributes to the formation of more positive attitudes. However, it is suggested that the poorer attitudes of the less able are not totally due to their having the least to offer academically. Evidence obtained in a study of streaming in the primary school (Barker Lunn, 1970) suggested that the behaviour and attitudes of the teacher influenced their pupils' attitudes. Teachers varied in their attitude to pupils of different ability, and the general trend was for a less favourable response to duller pupils. Such teacher values, it was found, were related to the pupils' attitudes, to their sense of security and to their self-esteem. There was evidence, too, that the way in which a teacher responded to an individual pupil influenced his interpersonal relationships in the classroom—when the teacher tended to dislike the less able, the class tended to follow suit. But when the teacher accepted such pupils the tendency was for no such rejection. All this suggests that the negative feelings of the less able may be exacerbated by the attitudes of their teachers.

Social Class.

There is a paucity of work relating attitudes to social class. However, Fitt (1956) in New Zealand and Coster (1958) in the United States, concluded that pupils of

higher social class had better attitudes to school. The results obtained by the boys in this study are in line with these findings: with the exception of 'other image' and conforming attitudes, more positive attitudes tended to be associated with boys from middle class homes and more negative feelings with those from working class homes. For the girls, however, half the scales showed a significant relationship with social class (personality and social relationship) and the other half, with the exception of importance of doing well, showed no such relationship. Such an association could be influenced by achievement as there is a moderately high correlation between social class and achievement—one might expect middle class pupils, since they tend to be the more able, to have more favourable attitudes, and working class pupils, since they tend to be the less able, to have less favourable attitudes. Unless achievement level is held constant when analysing by social class, it is difficult to determine the separate effects of these two variables. Thus, analyses were carried out within achievement groups and although social class trends still persisted, differences became smaller and the majority became statistically insignificant. Some of the trends for boys of above average achievement and boys of below average achievement, however, did reach the 5 per cent level of statistical significance, even though numbers were small (see Table 1). For girls, and for boys of average achievement, social class differences were less pronounced and none was significant.

TABLE 1

COMPARISON OF ATTITUDE SCORES BY SOCIAL CLASS, FOR CHILDREN OF ABOVE AVERAGE
- AND BELOW AVERAGE ACHIEVEMENT.

Scale	Boys* Above average			Boys Below average			Inference
	χ^2	df	P	χ^2	df	P	
Attitude to school	33.8	10	.001	28.5†	6	.001	In all comparisons, boys from middle classes had most positive attitudes; boys from lower working-classes had most negative attitudes.
Interest in school work	26.8	10	.01	19.1	10	.05	
Importance of doing well	27.3	10	.01	15.3	8	.05	
Academic self-image	31.8	10	.001			NS	
Anxiety in the class-room	17.8	8	.05			NS	

* No significant differences were found for girls, or for boys of average achievement, or for the other attitude scales.

† In this case comparison made between upper working class and lower working-class group.

Another noteworthy finding was the insignificant difference between the attitudes of boys of *average* ability from middle class homes and those of *above average* ability from working class homes. Here one might have expected the latter brighter boys to have had the more favourable attitudes. In fact, the reverse was the case: more of the latter tended to obtain low attitude scores. These findings suggest that although these working class boys experience success and do better academically in school, some factor perhaps stemming from the home detracts from their satisfaction and adjustment to school life. Other workers (Plowden, 1967) have shown that a child's school achievement is determined to some extent by his parents' attitudes which are partly determined by their material circumstances and by their socio-economic status.

It would seem that the different attitudes of pupils of different social classes can partly be accounted for by differences in academic performance, but this is not

the full explanation. It is suggested that parents' values and attitudes influence to some extent the child's feelings and acceptance of school.

One further explanation is needed for the apparent weaker relationship between social class and the attitudes of girls. It has been suggested already that girls adapt more easily to primary school because of their emotional make-up; the findings also suggest that the teacher-pupil relationship is closer for girls than for boys. Possibly the support necessary for positive school attitudes is aided by such a relationship. Also it is suggested that their greater placidity and conformity at this age helps girls to develop positive attitudes, and perhaps the negative feelings to school of working class girls' parents become a little less important.

(Detailed tables may be obtained from the author).

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(Manuscript received 6th May, 1971)

DIFFERENTIAL EFFECTS OF STREAMING ON PRIMARY SCHOOL
ATTAINMENT

By P. LEVY

(Department of Psychology, University of Birmingham)

AND JOAN TUCKER

(College of Education, Coventry)

SUMMARY. Studies of streaming policy typically show small differences in average attainment between different school regimes. Data are presented for 13 mixed-sex junior schools which show different effects of school regime on boys' and girls' attainment in relation to intelligence. Individual differences in Reading and Comprehension are more strongly related to differences in intelligence among boys in streamed schools and among girls in non-streamed schools. The finding for Arithmetic is in the same direction but cannot be stated with the same confidence.

INTRODUCTION

An early review by Yates and Pidgeon (1959) concluded that, due to the small amount of research devoted to assessing the consequences of streaming, it was possible neither to justify the criticisms levelled against it nor to prove that streaming is an effective form of organisation. The evidence about the effects of streaming on attainments remains equivocal. Daniels (1961), for example, presented evidence favouring non-streamed children, but Morris's data suggested an advantage in reading for streamed children, particularly in the earlier years of schooling (Morris, 1959, 1966). Barker Lunn (1967) found that most of the differences in attainment favoured streamed children but she cautioned: "Few of the differences, however, were large" and that "Some would consider (the loss in average achievement) a small price to pay for non-streaming, if other educational and personal advantages were obtained" (p. 59).

It may be argued, however, that streaming or non-streaming gives only the crudest characterisation of school regime. Barker Lunn (1967, p. 49) found that streamed schools had, on average, older teachers and poorer class facilities, that the children received more frequent formal arithmetic work and formal tests, and that their teachers more often favoured physical punishment, had lower tolerance for classroom noise, regarded the 11+ examination as fair, and had attitudes which favoured A-stream children. It may be features such as these which transmit the effects, if any, of the school regime. Thus, the fact that a school is streamed or non-streamed may be regarded as just one sign of other and correlated differences in regime. As Barker Lunn stated: "... differences between teachers in their methods and attitudes might possibly outweigh the effects of streaming or non-streaming *per se*" (p. 47). Nevertheless, the labels 'streamed' and 'non-streamed' afford a rough summary of such differences and remain the focus of discussion.

Typically only simple differences in attainment between school regimes have been reported. There would seem to be no grounds for expecting that simple comparisons of this type will ever show such clear and marked differences to enable a definitive answer to this complex issue. Apart from a study by Douglas (1964), which reported changes in ability within upper and lower streams between the ages of 8 and 11, we have seen no study of higher order, differential effects of school regime. Specifically, a three-factor interaction might be hypothesised relating intelligence, sex and school regime to attainments. If we suppose that the educational regime implied by streaming is more consonant from a cultural point of view with male expectations (crudely, 'competitiveness') and non-streaming with female expectations, then boys and girls will respond differently in the two regimes. This does not necessarily mean that boys will perform better on average in streamed schools, but that the system will accentuate differences in intelligence and motivation among boys, more so than among girls. It is suggested that the converse will occur in unstreamed schools; that girls respond with a greater differential effect

than boys to the less directly competitive, unstreamed regime. Again, this does not necessarily mean that the girls will perform better on average, but that their range of individual differences in ability and motivation will be utilised more strongly than for the boys. The data we now present are used to seek support for these hypotheses.

THE PRESENT STUDY AND RESULTS

The present data were collected as part of an educational survey carried out in a Midlands borough (Tucker, 1965). The Moray House Picture Intelligence Test 1, the Schonell Graded Word Reading Test, the Schonell Silent Reading Test A, and the Staffordshire Arithmetic Test, were administered to over 900 children in thirteen mixed-sex schools. The tests will be referred to by the short titles, Intelligence, Reading, Comprehension and Arithmetic. The children were tested in their first year of junior school, or at an equivalent stage in combined infant-junior schools, and at different dates throughout the school year, ages at testing being 7 or 8 years. The schools were identified as 'Streamed' (S) or 'Non-streamed' (N) by consensus among the staff of the local child guidance clinic who knew the schools. Eight schools were designated as S schools and five as N schools. Means and standard deviations were calculated for each of the four tests within each school-sex combination. The means show some variation on all tests, particularly from school to school, with less marked variation between the sexes. A summary of these data is given in Table 1.*

TABLE 1

MEANS AND STANDARD DEVIATIONS BY SEX AND SCHOOL REGIME FOR FOUR TESTS.

		Intelligence		Reading		Comprehension		Arithmetic	
		B	G	B	G	B	G	B	G
Streamed Schools	Mean sd†	107.4 15.6	108.7 15.3	99.4 22.0	104.0 17.7	100.1 19.0	105.1 17.6	96.1 11.1	99.1 10.9
Non-streamed Schools	Mean sd†	105.9 15.5	105.9 15.3	95.2 19.8	98.7 17.1	100.0 18.6	101.0 17.4	91.0 7.3	91.4 7.9

† Average within-school standard deviation.

The hypothesis to be tested is that streaming by ability or its absence has a differential effect on the achievements of boys and girls. It is suggested that in S schools individual differences in intelligence among boys are more strongly reflected in attainment differences than among girls; whereas in N schools individual differences in intelligence among girls are more strongly related to attainment differences than among boys. A three-factor interaction is by no means an easy relationship to comprehend. We may conveniently compound one of the factors, intelligence, with the dependent variable, attainment, by computing regression slope coefficients showing the attainment 'payoff' for differences in intelligence. Thus, a regression coefficient of, say, 0.5 may be interpreted as saying that difference of one point of intelligence is linked on average with a difference of one-half point in attainment. Thus, the higher the value of the regression coefficient for estimating attainment from intelligence, the steeper the regression slope and the greater the difference between the average attainment of those having higher and lower intelligence test scores. There is no necessary implication that school or sex groups having different regression slopes will have different average attainments. Our hypothesis suggests that regression slopes, not average attainments, will be higher for boys than girls in S schools but higher for girls than boys in N schools.

* The full data on means and standard deviations are available from the authors on request.

The regression slopes for each of the three attainment tests on the intelligence test scores calculated within each school-sex combination are given in Table 2.

TABLE 2

REGRESSION COEFFICIENTS ($\times 100$) FOR EACH OF THREE ATTAINMENT TESTS ON INTELLIGENCE TEST SCORES WITHIN SCHOOL-SEX COMBINATIONS.

	Ns.		Reading		Compre- hension		Arithmetic	
	B	G	B	G	B	G	B	G
Schools								
1	65	52	49	42	27	35	13	34
2	40	41	107	62	66	47	49	41
3	42	42	74	44	89	62	46	45
4	46	49	91	70	99	78	60	62
Streamed (S)	5	38	31	109	80	88	74	48
6	27	34	96	59	69	52	25	30
7	15	20	104	77	95	84	90	35
8	8	6	116	23	58	32	46	34
Means, S schools	35	34	93	57	74	58	47	42
9	50	56	70	78	43	66	25	29
10	36	32	49	65	42	57	08	25
Non-streamed	11	32	41	57	70	99	22	35
(N)	12	23	27	69	89	101	28	42
13	26	21	59	71	28	71	26	30
Means, N schools	33	35	61	75	55	79	22	32

The slopes vary quite widely from a low of 0.08 for Arithmetic among boys in an N school to a high of 1.16 for Reading among boys in an S school. The ratios of boy to girl regression slopes also vary widely from school to school. The table shows that boys have the higher average regression slopes for all three attainments in attainments in S schools, whereas girls have the higher average regression slopes for all three attainments in N schools. The marked variation in regression coefficient from school to school and between the sexes leads us to question the value of published regression equations (Fransella and Gerver, 1965; Ravenette, 1961; Savage and O'Connor, 1966; Yule, 1967) for predicting attainment for children of unspecified sex and school regime.

TABLE 3

CONTINGENCY TABLES SHOWING THE NUMBER OF STREAMED AND NON-STREAMED SCHOOLS IN WHICH BOYS OR GIRLS HAD THE HIGHER REGRESSION OF ATTAINMENT ON INTELLIGENCE.

	Reading		Comprehension		Arithmetic	
	B	G	B	G	B	G
Streamed	8	0	7	1	4	4
Non-streamed	1	4	0	5	0	5

Fisher Exact Test: $P=0.007$ $P=0.005$ $P=0.098$

Table 3 summarises these data and shows the number of S and N schools in which either the boys or the girls have the higher regression slope for each of the

three attainment tests. For Reading, boys have the steeper regression slopes in all eight of the S schools, but girls have the higher slopes in four out of the five N schools. Similarly, for the Comprehension test, only one result in 13 is anomalous, girls having a higher regression coefficient than boys in just one of the S schools. These results, treating schools as the units for analysis, are statistically significant well beyond conventional levels by the Fisher Exact Test for 2×2 tables (e.g., Maxwell, 1961, pp. 23-26). The result for Arithmetic does not reach a conventional level of statistical significance ($.10 > P > .05$), although the absence of an N school in which boys achieve a higher regression slope for their differences in intelligence is in line with the original hypothesis.

Again, it should be emphasised that a higher regression slope does not necessarily mean a higher average attainment but merely a greater range of attainment for the same range in intelligence; or, a greater dependence of individual differences in attainment upon differences in intelligence. In fact, the S schools in the present sample do achieve more on average than the N schools, but since the schools may not be comparable for the purpose of making such a statement we would not wish to stress this point. Rather we would wish to point to the consequences of the more compound differential effects of regime and sex. Consider the average regression slopes found for Reading in the four sex-regime groups. One way of illustrating the effects we are discussing is shown in Table 4.

TABLE 4

ESTIMATED MEAN PERFORMANCE IN READING OF UPPER AND LOWER 10 PER CENT ABILITY GROUPS BY SEX AND SCHOOL REGIME.

Regime \ Ability	Boys		Girls	
	Upper	Lower	Upper	Lower
Streamed	124.5	75.5	115.0	85.0
Non-streamed	116.1	83.9	119.8	80.2

The expected average Reading scores have been calculated for the upper and lower 10 per cent of intelligence test scores among children whose average attainment is set at 100 with a standard deviation of 15 points. Clearly, marked differences can appear between the achievements of the very able depending upon which regime a child of a particular sex undergoes. The more extreme the group considered the more marked will be the differences in achievement. The effect is particularly marked among boys. Since these data are computed from average regression slopes there exist schools in which the sex differences for high and low intelligence groups are much larger and others in which they are much smaller. We note that the size of the difference between sexes within schools is similar to the largest differences reported by Barker Lunn (1967) for gross differences in attainment between schools.

CONCLUSION

Results from studies of the effects of streaming policy on scholastic attainment typically refer to the simple average differences produced. Such differences are said to be small even when the differences are in the same direction. The results of the present study show a difference between streaming regimes in their utilisation of individual differences in intelligence. The streamed schools in our sample make more use of differences in intelligence for boys than for girls; or, it could be said, that attainments within streamed schools depends more heavily on differences in intelligence among boys. Whether we are to regard the phenomenon as 'greater

capitalisation on intelligence' or 'overdependence on intelligence' requires a statement of social values, upon which we wish to make no comment. Even if the two regimes were to produce the same average performance from their pupils, our data suggest that different outcomes would appear for boys and girls among those higher and lower than average in intelligence. These sex differences within schools can be at least as marked as the previously reported simple differences between regimes.

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(Manuscript received 31st May, 1971)

ON THE MEASUREMENT OF EGOCENTRISM : A REPLICATION AND EXTENSION OF AEBLI'S FINDINGS

BY J. GARNER AND E. L. PLANT

(Department of Educational Research, University of Lancaster)

SUMMARY. An experiment was conducted to confirm that the egocentrism demonstrated in Piaget's 'three mountain' experiment was more a function of his experimental design than of the children's thought. 255 children between the ages of 6 and 8 years were asked to select the views that would be obtained from examining an array of objects from several vantage points. It was shown that children asked to find their own view first showed significantly higher levels of 'egocentric response' (i.e., selecting their own view for other vantage points) than children who selected the other views first. This was taken to indicate that the 'egocentric responses' had been cued by the experimenters requesting an 'egocentric response' prior to the test.

INTRODUCTION

Aebli (1967) has drawn attention to an apparent artefact in the 'three mountain' experiment that Piaget and Inhelder (1956) used as evidence of intellectual egocentrism. An operational definition of intellectual egocentrism is provided by a description of Piaget and Inhelder's initial experiment. Children were presented with a model of three mountains. The child was seated in front of the model from

which he could see a green mountain in the right foreground with a little house on the summit, a higher brown mountain topped by a red cross placed to the left of the green mountain, and a taller still grey mountain with a white peak placed behind and between the other two. He was then shown a collection of 10 pictures which showed the model mountains from different viewpoints, and was asked to select that picture which represented his own view. Having done this successfully, a small wooden doll was placed in a number of different positions around the model and the child was asked to select the view that the doll would see from amongst the various available pictures. A child's responses were deemed to be egocentric if the child selected his own view of the mountains and attributed this to the variously placed doll, egocentrism being essentially an inability to distinguish between one's own viewpoint and that of another. Thus, an egocentric child would decide that his view must be held by the doll since his view is the view that *everyone* has. Aebli (1967) pointed out that a child's choice of his own view might well be a consequence of the experimental design; the child, finding the problem insoluble, resorts to the one response known to be acceptable to experimenter, i.e., his own view, thus being classified as egocentric. Aebli proceeded to test this possibility by comparing the responses of a group of children who were asked to find their own view first with the responses of children who did not determine their own view until after they had selected the views seen by the doll. His results confirmed his expectations, there being a higher proportion of 'egocentric' responses in the 'own view first' group than in the 'foreign views first' group.

The experiment to be described consisted of a replication of Aebli's study, utilising a problem similar to that used by Aebli and an additional problem more akin to Piaget and Inhelder's 'three mountain' problem. In this way the generalisability of Aebli's findings across problems was examined in addition to the replicability of his initial findings.

It should be noted that this study is concerned with the possibility that experimental procedures might lead a child to emit an egocentric response when his thinking is not in fact egocentric, and not with egocentricity in children's thought as such. It follows from the above discussion, however, that children in the group finding their own view after finding the doll's views who respond with consistent egocentric responses might well be egocentric. On the other hand, children who respond consistently in an egocentric mode might have produced their own solution to the insoluble problem within the experimental session: as a check on this, each child was asked the question, "Would the doll's view from x position be the same as yours?" If the reply to this question was 'yes,' and his responses had shown a consistent tendency towards egocentrism then he was classified as a consistent egocentric.

The following hypothesis was examined:

That the number of egocentric responses will be greater within the 'own view first' group than in the group determining their own view after the doll's views.

METHOD

Sample. The complete upper age group of an infant school, 124 children with a mean age of 6 years 11 months (range 6 years 7 months to 7 years 1 month), were selected as the younger age group. The complete lower age group of the junior school that received its children from the above infant school, 131 children with a mean age of 8 years 1 month (range 7 years 10 months to 8 years 5 months), was selected as the older age group. The children were randomly assigned to two groups at each age level.

Apparatus. The materials for problem A consisted of three plastic models placed in a triangular pattern on a grey base board. The plastic models were a house with white walls and red roof measuring 12 cm. long, 5 cm. wide and 10 cm. high, a red model bus measuring 11 cm. long, 3 cm. wide and 5 cm. high, and a green model car measuring 7 cm. long, 3 cm. wide and 2 cm. high. The base board was circular (diameter 60 cm.), and the objects were placed at the corners of an equilateral triangle of sides 30cm. long.

Six coloured photographs, 12 cm. by 9 cm. were taken to provide six different views of the objects from six equally spaced positions around the circular base. Sets of the six different views were mounted on three separate cards; the pictures were arranged in two rows of three, the order varying from card to card.

The materials for problem B possessed greater symmetry than those for the easier problem, and consisted of an inverted white plastic pouring funnel 10 cm. high and 8 cm. diameter at the base, a green plastic cylinder, 12 cm. high and 6 cm. diameter, and a brown wooden cone, 7 cm. high and 7 cm. diameter. These were placed on a circular base board (diameter 60 cm.), and the objects were placed at the corners of an equilateral triangle of sides 20 cm. long.

Six coloured photographs 12 cm. by 9 cm. were taken and arranged as for the earlier problem.

Procedure. Each child was tested individually in a small quiet room by the senior author. The child was seated before a table on which were displayed the board and objects and one set of the six different photographed views of the apparatus. Children in Group A (the 'own view first' group), were asked to determine their own view of the apparatus from amongst the six photographs. After a child had found his own view (indicating that he was aware of the nature of the task) a small plastic doll was placed in each of the remaining five positions around the display, each position being diametrically opposed to the one preceding it. For each position of the doll the child was asked, "If you stand where the doll is standing which picture shows what it would look like?" The three cards of photographs were interchanged for each position of the doll. When answers had been received for the first set of five doll positions, the entire procedure was repeated, giving a total of 10 attempts at identifying the doll's view. Following this the child was again asked to find the picture corresponding to his own view, the doll was placed in one of the 'other view' positions, and the child was asked, "If the doll painted a picture from his position, and you painted one from your position, would the pictures look the same?" He was then asked to explain the reasons for his answer.

The children in group B (the 'other view first' group) followed the same procedure as group A except that they were not asked to find their own view before the test series began.

Children in both groups were tested on a second problem two weeks after the first: half of the children within groups A and B were given problem A first, the other half being given problem A second. Assignment to problem order group was again randomly determined.

Thus, there were eight subgroups each completing two problems:

<i>Infants</i>	Group A	Own view first:	problem B first.
	Group B	Own view first:	problem A first.
	Group C	Other view first:	problem B first.
	Group D	Other view first:	problem A first.
<i>Juniors</i>	Group E	Own view first:	problem B first.
	Group F	Own view first:	problem A first.
	Group G	Other view first:	problem B first.
	Group H	Other view first:	problem A first.

RESULTS

Prior to the tests of the research hypothesis, tests were carried out to examine the order effects. Comparisons were made between group A and B, C and D, E and F, G and H, for the two problems, the children's scores on each problem being the number of egocentric errors made in the 10 test trials (Egocentric errors were defined as an inappropriate choice of the photograph representing the child's own view). A Mann Whitney U-test (Siegel, 1956) was used to effect the comparisons, and the resulting 'z' values are shown in Table 1A. None of these values approach a 5 per cent confidence level, and in the absence of an order effect the pairs of groups were combined for subsequent analyses.

TABLE 1

EFFECTS OF ORDER OF PRESENTATION OF PROBLEMS (1A) AND OF DIFFERENCES IN EGOCENTRIC RESPONSES BETWEEN 'OWN' AND 'OTHER VIEW FIRST' GROUPS (1B).

Group 1A	Easy problem				Difficult problem			
	A v B	C v D	E v F	G v H	A v B	C v D	E v F	G v H
'Z'	0.67	0.08	0.52	1.27	1.35	0.33	0.17	0.43
P	.251	.468	.302	.102	.089	.371	.432	.334
Group 1B	Easy problem				Difficult problem			
	A and B <i>versus</i> C and D		E and F <i>versus</i> G and H		A and B <i>versus</i> C and D		E and F <i>versus</i> G and H	
Mean 'E' errors	3.98	2.39	2.98	2.09	5.35	2.93	4.13	2.34
'Z'	3.32		4.04		3.83		6.00	
P	.0005		.00002		.00007		.00001	

The hypothesis was that the number of egocentric errors will be higher within the 'own view first' group than within the group determining their own view after the doll's views. The test of this hypothesis involved four comparisons, groups A and B *versus* C and D, E and F *versus* G and H, being compared on each of the two problems. A Mann Whitney U-test was again used, and the results of these comparisons are shown in Table 1B. These results indicate that hypothesis 1 was supported at each age level for each of the two problems.

The incidence of consistent egocentrism (defined as an incorrect choice of his own view on six or more trials on any problem and the giving of an egocentric response to the question "would the doll's view from position X be the same as yours?") differed between the two conditions. The proportion of consistent egocentrics was 28 children out of 254 in the own view first groups, and 15 out of 256 in the other view groups. This difference between conditions is significant ($\chi^2=4.40$, $df=1$, $P<.05$).

DISCUSSION

Aebli's contention that Piaget and Inhelder's administration of the 'three mountains' problem led to an overestimation of the number of children classified as egocentric receives strong support from this study. Aebli's study (Aebli, 1967) was replicated and the same effects were obtained with a change of problem. It would appear that the facts of the matter are clear: asking the children to select their own view first disposes them to select it more frequently thereafter than is the case when no such prior selection occurs.

The findings from this study point to the conclusion that extreme caution must be exercised in assuming that test procedures uncover, rather than produce, children's thoughts. The differences between the 'own' and 'other' view groups in their production of egocentric choices, confirmed at two age levels and for two problems, indicate most clearly that the experimental arrangements for the former group *produced* egocentric responses. This point is even more forcefully made by the evidence on the responses to the question about the doll's view. In designing the experiment it seemed eminently reasonable to assume that concurrence of choices and verbalisation would indicate a 'genuine' egocentrism, but the higher incidence of this 'genuine' egocentrism in the 'own' than the 'other' group leaves even that assumption open to doubt. The possibility must be considered that, having made consistent egocentric choices (for the reasons due to the experimental arrangements) the children then *produced* verbal responses that were consistent with their choices.

This study is yet another addition to the cautionary tales regarding investigations into the thought of the child, and indicates the necessity for a clear understanding of the effects of the measuring instrument on the phenomena being measured.

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(Manuscript received 2nd June, 1971)

AGE AND SUSCEPTIBILITY TO SAME SEX PEER PRESSURE

By J. K. COLLINS AND N. T. THOMAS

(School of Behavioral Sciences, Macquarie University, Australia)

SUMMARY. 100 male and female students between the ages of 5 and 19 years were subjected individually to an obviously and unanimously wrong decision by a group of their same-sex peers. Conformity differed among the age groups but not between the sexes. Maximum conformity was found in the adolescent age group.

INTRODUCTION

Duncker (1938) and Hunt and Synnerdahl (1958) showed that young children were not susceptible to peer group pressure, probably because their awareness of the social contingencies involved was not sufficiently developed for this type of pressure to influence their behaviour. However, as the child learned to adjust to school discipline, as he participated in group activities and as he learned that many of his satisfactions were dependent on membership of the peer group, he became more likely to yield to same-sex peer pressure. These observations led Mussen *et al.* (1966) to maintain that yielding to same-sex peer pressure should increase with increasing age during middle childhood. Later, maturation and educational achievement lead to a lesser degree of dependence on the peer group. Berenda (1950) found that children in late childhood yielded less to same-sex peer pressure than children in middle childhood.

The onset of adolescence again puts the child under pressure to conform to the behaviour of his peers. Many authors (Ausubel, 1954; Hurlock, 1967; Rogers, 1969; Jersild, 1963; Crow and Crow, 1965) have found conformity to peers to be a prominent pattern of behaviour during adolescence. But as the adolescent matures additional factors come into play causing a decrease in conformity. New responsibilities in the preparation for a vocation and marriage, stabilisation of status and greater competence create more confidence and reduce dependency on the group (Marple, 1933; Patel and Gordon, 1960).

From the various investigations cited above it was hypothesised that yielding to same-sex peer pressure would be low in early childhood, increase during middle childhood, decrease during the pre-adolescent years, reach its maximum during the adolescent years and decline in the late adolescent years.

METHOD

Subjects. The critical subjects were 50 male and 50 female school pupils ranging in age from 5 years to 19 years, attending two state primary and two state

high schools in the Sydney Metropolitan Area. Twenty subjects, 10 male and 10 female were assigned to each of five age groups—an early childhood group (5 to 7 years), a middle childhood group (7 to 10 years), a pre-adolescent group (10 to 13 years), an adolescent group (13 to 16 years) and a late adolescent group (16 to 19 years). These subjects were randomly selected from the attendance rolls. The majority peer group consisted of five children from the same class as the critical subjects. Each majority group attended an average number of seven experimental sessions with successive critical subjects.

Procedure. The critical subjects were required to make matching judgments using three lines of different lengths and a standard line. A trial consisted of the successive presentation of three cards, on each of which the standard was paired with a comparison line. On one card the comparison was longer than the standard, on the other it was equal to the standard and on the third it was shorter than the standard. The subject was required to select on which card the standard was equal to the comparison. The stimuli were projected onto a screen for a fixed exposure period of 33 msec. The sizes of the lines were kept constant for all subjects. The exposure time was selected after a series of preliminary trials had established that subjects could attain 100 per cent accuracy at this speed.

There were 12 trials, on five of which the members of the majority group responded correctly. These trials were called neutral trials. The two opening trials were neutral and from then on a neutral trial occurred after every two critical trials. For the critical trials the majority group had been instructed to give a predetermined incorrect answer. The experiment was carried out in the school from which the subjects were drawn. The group distributed itself in two rows. The seating was arranged so that the critical subject always sat next to the last seat in the second row, where he could hear the judgments of all but one person before it was his turn to speak out.

A control session was conducted to ensure that under the absence of pressure to yield all subjects could make judgments with 100 per cent accuracy. Any subject who deviated from this criterion was replaced. All subjects were tested individually during both control and experimental sessions. Half of each group of subjects was tested under control conditions before, and the other half after, the experimental session. A debriefing session in which the purpose of the experiment was explained to all pupils was given after the experiment had concluded in each school.

RESULTS

The conformity score for each subject was the number of times his responses agreed with the erroneous responses of the majority group. The score for any given subject could range from zero (no yielding) to seven (complete yielding).

The means and standard deviation for each group are shown in Table 1. The results were analysed using a 2×5 factorial design involving sex and age groups.

TABLE 1

MEANS AND STANDARD DEVIATIONS OF YIELDING SCORES TO SAME SEX PEER PRESSURE.

	Age	5-7	7-10	10-13	13-16	16-19
Males	Mean	3.9	4.3	2.6	5.6	2.9
	sd	2.8	3.1	2.5	2.5	3.13
Females	Mean	4.7	4.9	4.0	6.3	3.5
	sd	3.04	2.9	3.1	1.54	2.9
Total Group	Mean	4.3	4.6	3.3	5.9	3.2
	sd	2.8	2.9	2.7	2.0	2.7

While the scores of the age groups differed significantly ($F_{4,90} = 4.487$, $P < .01$) no significant differences were found between the sexes ($F_{1,90} = 1.435$, $P > .05$) or in the interaction term ($F_{4,90} = 0.078$, $P > .05$). The yielding scores of the boys and girls were combined and Bonferroni's multiple t statistic was used to test the differences between age groups (Miller, 1966). Accordingly, the critical value at the .05 level for a significant difference was 2.104. From the group results in Table 1 it can be seen that this criterion was reached in the differences between the pre-adolescent and adolescent group, and the adolescent and late adolescent group.

DISCUSSION

The results generally support the hypothesis outlined above. The degree of yielding increased from the early childhood to the middle childhood group, decreased in the pre-adolescent group, then increased to a maximum in the adolescent group before decreasing in the late adolescent group. It appears that the development of a yielding tendency to same-sex peers is closely related to the child's socialisation process. The child in his early development is usually less aware of the social pressure exerted by his peers than is the older child and the status hierarchy of social roles may be less definite to the infants. Thus, the effect of a unanimously wrong majority may be perceived as less threatening in terms of loss of companionship or status to the 5- to 7-year-old than to the 7- to 10-year-old critical subject. Although the pattern of yielding appears to support the prediction, yielding in the youngest group was not significantly lower than yielding in middle childhood. One possible explanation is that the early childhood group were not young enough to demonstrate conclusively the increasing trend. These children might have already undergone sufficient social experience in kindergarten and nursery schools to become more susceptible to peer pressure than had been expected. The decrease in yielding in the pre-adolescent group although not significant was consistent with the findings of Berenda (1950) who reported that children between 7 and 10 years yielded more to same-sex peers than did those between 10 and 13 years of age. The significant spurt of yielding in the adolescent group lends decisive support to the theory of peer group power in adolescence. During the transitional stage between childhood and adulthood, the individual is ready to rely upon his social peers or yield to their pressure, and no doubt his conformity in many behaviour patterns (fashion, haircut and manners) is related to this susceptibility. By late adolescence, new responsibilities reduce the individual's dependence on the peer group, which would be expected in turn to cause a reduction in yielding to it.

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(Manuscript received 24th June, 1971)

THE WHEEL AND THE TABLE: THE RELATIVE MERITS OF TWO ALTERNATIVE INSTRUMENTS FOR COLLECTING SEMANTIC-TYPE DATA

By C. ORPEN

(University of Cape Town, South Africa)

SUMMARY. A number of semantic scales were presented to subjects in either a wheel format or a more traditional tabular format. The wheel is shown to be (a) more reliable; (b) less susceptible to patterning of responses, while (c) the influence of ordering of scales on responses is reduced. It is contended, therefore, that it is better, in certain circumstances, to use the wheel format rather than the conventional format in collecting semantic-type data.

INTRODUCTION

Encouraging results have been reported for a novel way of collecting semantic-type data in which the pairs of descriptions are printed as spokes of a wheel on a circular card (wheel). Using this format it is possible to present up to 70 scales in an unusual way that is said "to elicit an enthusiastic response" (McNamara, 1971). The wheel has been used so far to collect information for market research purposes (Thomas *et al.*, 1967) and to elicit the feelings of students about their college (McNamara, 1971). According to McNamara there are two ways in which the wheel is an improvement over the more usual tabular type of presentation in which the pairs of descriptions are set underneath each other (table). First, it is less susceptible to patterning of responses, due to the fact that the subject can readily read only one scale at a time (the wheel format makes it necessary for him to turn the card continually and consider each scale separately). Secondly, there is less chance that responses will be affected by the way in which the scales or pairs of descriptions are ordered, due to the fact that the wheel has no starting or finishing point and either side of the card may be completed first. (This makes it reasonable to assume that the starting point for completing the scale will be randomly selected by the subject).

No empirical evidence is available to support these contentions, nor to compare the relative reliability of the wheel and tabular presentation of the same semantic scales (pairs of descriptions). In addition the wheel has not been used to collect information about how subjects see themselves—the most common use of semantic differential scales.

PROCEDURE

70 pairs of adjectives (and their opposites) taken from Allport's list of trait names (Allport and Odbert, 1936) were given to two independent judges—final-year schoolboys—who stated which of the two adjectives in each pair described the more desirable end of each continuum. This list of 70 adjective pairs included six pairs which described traits that all load heavily on the introversion-extraversion dimension (Eysenck *et al.*, 1969). There was complete agreement between the judges as regards the more desirable adjective in the case of 58 of the adjective pairs (these adjective pairs included the six which described 'introversion-extraversion' traits, these six being termed 'synonyms').

These 58 pairs of adjectives were printed as spokes of a wheel on a circular card of diameter 8½ in. (215.9 mm.) with 29 pairs on each side of the card and the more 'desirable' of each pair of adjectives at the centre of the wheel. The 'synonyms' formed a series that was followed (clock-wise) by the key adjective-pair—introvert-extravert. It was felt that this ordering would, in itself, influence the way the subject responded to the introvert-extravert scale.

The same 58 pairs of adjectives were also printed one below the other in the traditional tabular form. The order was the same as in the wheel, with the more 'desirable' of each pair of adjectives on the left-hand side and the six 'synonyms' followed (underneath) by the key adjective-pair—introversion-extraversion.

124 schoolboys (average age 17.8) from urban middle-class homes were asked to rate themselves according to standard instructions on a seven-point scale of introversion-extraversion. A week later half of them were given the wheel and the other half the table. A month later the first half were again given the same wheel and

the second half the same table. The instructions for the wheel and the table were the same except for the insertion of the words 'wheel' and 'spoke' for 'table' and 'line.' In both cases the standard instructions for semantic-type scales of Osgood *et al.* (1957) were used.

RESULTS

The scales comprising the wheel and table were keyed in a 'desirable' direction to yield total scores for each subject on either the wheel or the table. The reliability coefficient of the wheel ($\rho = .74$, $P < .01$) was higher than that of the table ($\rho = .60$, $P < .01$) when the rankings of the subjects, in terms of their total scores, were compared. In addition, the mean of the difference-scores of the subjects given the table was significantly higher ($t = 2.69$, $df = 122$, $P < .01$) than that of the subjects given the wheel.

The difference between the mean scores of the subjects on the introversion-extraversion scale when it was given initially (on its own) and when it formed part of the wheel was non-significant on the first administration of the wheel ($t = 1.87$, $df = 61$, $P > .05$) and just significant on the second administration ($t = 2.01$, $df = 61$, $P < .05$). However, the difference between the mean scores of the subjects on the introversion-extraversion scale when it was given initially (on its own) and when it formed part of the table was significant at the .01 level on both the first administration of the table ($t = 2.82$, $df = 61$, $P < .01$) and the second ($t = 2.71$, $df = 61$, $P < .01$).

The degree of patterning of the subjects' responses on the wheel and table was ascertained by making tracing-copies of their responses (by joining up their 'marks' on the various scales) and giving these copies to three independent judges—also final-year schoolboys—who were asked simply to state whether a given tracing-copy formed a 'regular pattern' or not. A copy was considered to be 'patterned' only if all three judges agreed that it was. The judges were not informed as to whether the copy was derived from a subject's responses to the scales in the wheel or the table. The percentage of tracing-copies from the two administrations of the table that were 'patterned' by this criterion was significantly higher ($\chi^2 = 5.42$, $df = 1$, $P < .05$) than the percentage of tracing-copies from the wheel.

CONCLUSION

The wheel is shown to be both more reliable and less susceptible to patterning of responses than the table. If the significant change in the subject's responses to the key scale (introversion-extraversion) can be considered to be mainly due to the presence of a series of very similar scales ('synonyms') immediately preceding it in both the wheel and the table, then it is possible to use this change as an index of the influence of ordering of scales on responses. Accepting this, the wheel is also shown to be less susceptible to bias from ordering than is the table.

The results of this study, therefore, offer clear support for McNamara's (1971) contentions. Further research is needed to establish precisely what features of the wheel are responsible for these advantages it enjoys over the tabular-type of presentation. When the results of this study are combined with the novelty of the wheel and the report of McNamara's subjects that they 'enjoyed' completing it, then the wheel can be regarded as an improvement over the table in the collection of semantic-type data in certain circumstances.

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(Manuscript received 6th July, 1971)

BOOK REVIEWS

ABBOTT, J. (1971). *Student Life in a Class Society*. Oxford: Pergamon Press' pp. 640, £4.25.

This long book (592 pages plus a bibliography of 21 pages and indexes running to 26 pages) "began as an undergraduate study for a MA dissertation of the Honours Degree in Social Anthropology." In the event it is based on a large scale survey of students in three universities—Edinburgh, Newcastle and Durham—to show the part played by social class in student social relationships and organisations. Questionnaires, interviews and participant observation were techniques used. The analysis of qualitative data made it possible to re-appraise quantitative material but the author concedes that "any startling changes in the collection of quantitative data would have led to a total redefinition of the research problem and made meaningless the attempt at structural comparison. So the approach to and interpretation of facts developed within the confine of the research framework" (p. 111). How unfortunate it is when statistical methods in the social sciences become the message.

Dr. Abbott attempts, with success, to be scrupulously fair. Practically everyone who has written in the field of social class and education either as a sociologist or a comparative educationist receives mention. Great pains are taken to make clear the assumptions of method. A number of research problems in education are identified, hypotheses set up for investigation, techniques of enquiry stated, and conclusions drawn. As a doctoral thesis it could hardly be faulted on the grounds of technical competence. But in a book one hopes to find that the author has taken a critical look at methods of enquiry, has thoroughly understood one of them, absorbed it and applied it in a way which makes for a tightly drawn argument and clearly stated, and hopefully, novel conclusions.

This book, in this reviewer's judgment, does not measure up to these criteria. For example, Dr. Abbott seems unaware of the debate among philosophers of science on the relative merits of hypothetico-deductive methods of enquiry and induction. She seems to favour the former but started her enquiry by attempting "to gain as much information as possible on as many aspects of the subject as possible" (p. xv). Her attitude towards empirical 'proof' suggests that she is aware of the confirmation-refutation controversy but she fails to capitalise on this awareness. Finally, her theory of social change which is central to her work is implicit rather than explicit. These shortcomings result in a book that is well structured in the main but lacks conceptual coherence.

As for the author's conclusions the following are examples. She writes that "the social characteristics of the students, and their attendant modes of behaviour, will change as the structure of society changes. It is a circular process—reflecting the relation between thinking, acting man, and the constraints of his moral environment . . . Individual interpretation and choice in turn affects the pattern of future constraints by being a part of them . . ." (p. 533). In particular, "students are the product of their social environment; they are also able, consciously or unconsciously to produce changes within the social environment" (p. 533). To be fair, these general conclusions are as confirmation of the assumptions from which the author (and other sociologists) started. They add little to our understanding of social change and the rôle students may play in it. Dr. Abbott's more specific conclusions tend simply to confirm what a host of other research workers have discovered. For example, "there has been no vast expansion of working class students on the scale which was hoped or feared at the end of the 1940s" (p. 551).

But the key to the shortcomings of this book provided in the author's last paragraph. She writes, "As to the evidence of more subtle differences discussed in this book, we are led back to question what we mean by social class and what we experience of social class; and everything suggests that even within a privileged status group—as students are—social class differences are preserved" (p. 570).

This reviewer's conclusions are that had Dr. Abbott recognised more explicitly than seems to be the case Popper's contribution to social science research she would have saved herself a great deal of time. Had she made some prior conceptual analysis of the variables she handles empirically her measuring instruments would have had greater construct validity. Finally, had she identified *one* major problem, intellectualised it thoroughly and then proceeded to put alternative solutions (hypotheses) to the test, her book would have been shorter, more provocative and of greater interest and value.

BRIAN HOLMES.

ANTHONY, E. J., and KOUPERNIK, C. (Eds.) (1970). *The Child in his Family*. Chichester: J. Wiley and Sons, pp. xxxii+492, \$12.50.

The Foreword describes these 23 articles by 34 hands as an "international year-book" constituting, initially for the benefit of the International Association for Child Psychiatry and Allied Professions but now for a wider public, a "collection of noteworthy studies that reflect the present stage of development in our discipline." Well, how faithful is the image in his mirror?

Each article is concerned with the influence of some aspect of a child's family situation on his emotional development (and, to some extent, *vice versa*). Contributions are grouped into four sections, three of which are introduced by the credited editors. The first section, about different ways of conceptualising and investigating family dynamics, differs clearly from the last, which contains studies and speculations about how children in other cultures are affected by different environments and rearing-practices. But the two middle sections are both concerned with vulnerability and pathology in reaction to various sorts of stress, and this reviewer does not see why "A typical behaviour . . . in relation to the behaviour . . . of the mother" comes into section two, when " . . . interlocking pathology in family relationships" is in section three. Some other papers also seem more connected with those in different sections than with those in their own.

Minuchin, for example, spends two-thirds of his space in the first section describing a single case of eating disturbance, without referring to any of the three contributions (or contributors) on this topic in the third section; nor do the editors plug the gap for him. Similarly, Lebovici's essay on the psychodynamic theory of the family, also in the first section, leans heavily on traditional 'oedipal' notions, mentions Bion and Winnicott, and omits Laing *et al.* But, although the writer realises that anthropologists have questioned the universality of Freudian psycho-developmental crises, he makes no attempt to relate these ideas to the relevant variations in child-rearing reported in the fourth part of the book. (In this case, Condominas picks up the thread on p. 354.) Another chance to upgrade psychodynamic theorising in this area, by testing it against later observations and experiments, is missed by failing to take account of systematic studies into the relation between personality characteristics and family constellation, birth-rank and sibship-size.

Fortunately, Rutter's discussion of "Sex differences in children's responses to family stress," in the second section, raises the tone by making due reference to recent work on sex-role identification and parental conflict. But he joins Greenberg (same section) and Sula Wolff (section three, p. 280) in not acknowledging, as McCord *et al.* seem to have shown *pace* the Gluecks, that children's differential reactions to parental disruption are functions of the causes, nature and timing of the break, and of what remains by way of mothering and substitute father-figure. Lois Murphy writes on general vulnerability anecdotally and with firm psycho-analytic commitment; but it is convenient to have from Bowlby and Parkes a résumé of their findings and theories on 'object-loss,' even if some critics would insist that their colourful anecdotes about how bereaved people describe their feelings is the sort of 'soft' evidence which can plausibly illustrate almost any thesis but clinch none. However these writers' analysis and classification

of their 20 or so subjects' reports is systematic by comparison with Milde Bruch's 15 pages on a single richly-flavoured case, in that part (nearly a half) of section three which is devoted to the individual and family dynamics of eating disorders. (And why this disproportionate preoccupation with eating, almost to the exclusion of seizure states, enuresis, school-refusal or autism?)

In general this book has less of the rigour, originality, balance and comprehensiveness which its advertised *raison d'être* invites one to expect. There is too much consulting-room reminiscence in place of hard, controlled observation, and doctrinal commitment instead of precise hypothesis, for it to be regarded as representative of the current state of the game. Nobody doubts that technical terminology enables specific and specialised points to be made economically, but here it too often degenerates into case-conference jargon-mongering which is not an aid to objective clarity but a substitute for it. In the psychiatric seventies, few of our colleagues need to be reminded that different degrees of parental and environmental constraint are appropriate to different ages of childhood, and that a mother's "capacity for nurturance" is not "an entity" (p. 27). Nor are they impressed by pretentious neologisms such as 'ecosphere'—which means, I suppose, a kind of double-yolked igloo. Truly, "the present stage of . . . our discipline" is further advanced than this.

NEIL M. CHESHIRE.

BAKKER, D. J., and SATZ, P. (1970). *Specific Reading Disability: Advances in Theory and Method*. Rotterdam: University Press, pp. 166, D.F1.35.

The chapters which appear in this book were originally presented by the authors as papers at a symposium on reading disability during the International Congress of Applied Psychology in Amsterdam in 1968. The bias is towards a neuropsychological approach, perceptual and psycholinguistic aspects also being included, with treatment receiving only minimal attention. There is no discussion of the concept of specific developmental dyslexia. Critchley's definition is simply accepted and the book goes on to attempt a synthesis of the scattered and frequently inconsistent findings on dyslexia and lateralisation already in the literature and to present new research evidence.

The recurring hypothesis of a maturational lag in the whole of the left hemisphere, leading to retardation in the development of all lateralised functions, motor, somatosensory and language. In chapters 2 and 3, Satz and Sparrow examine and develop this hypothesis, postulating a hierarchical integration in the central nervous system, which, if delayed, would produce in dyslexic children not a unique syndrome but patterns of behaviour typical of younger children who have not yet acquired certain skills. Moderate immaturity in development implies that the ontogenetically earlier skills (e.g., gross motor) will be delayed in young dyslexics and the later developing skills (e.g., language) in older dyslexics. Again, on this hypothesis, Gerstmann-like symptoms could be expected to appear in older (ages 9-12) dyslexics more often than in younger (7-9). Not all of the implications have yet been tested but the authors claim that the work of de Hirsch and her associates lends considerable support to their formulations.

They themselves present the findings of their study on possible developmental aspects of laterality at four different ages (9-12 years), claiming that none of the early developing laterality measures differentiated their sample of retarded readers from the control groups but all of the measures of later developing laterality did so.

The chapter by Marian Annett is of a rather different nature. She argues for a genetic transmission of handedness and cerebral dominance, suggesting that both may be distributed in a binomial fashion. Clinically normal children who are consistent left-handers appear to be likely to be above average in vocabulary level, while mixed handedness is associated with slower vocabulary development. Incomplete lateralisation is not, however, in her opinion to be attributed to immaturity but is rather part of a normal distribution of individual differences.

The remaining chapters summarise research studies aimed to identify the precise deficits which produce reading failure in dyslexics. Retention of temporal order of sequences in meaningful material, where a verbal mediation process is required, is shown to be weak in poor readers. They are also said to be inferior in complex visual discrimination, failing more rapidly than the control subjects of similar age as the number of dimensions on which differences could occur increase. Orientation errors are discussed and, in the final chapter, it is proposed that not only are below average readers characterised by a smaller verbal output than average readers but they also tend to use modifications in the subject position rather than the predicate and to rely heavily on the 'existence' type of sentence (There is . . .).

This a thought-provoking book, a veritable mine of topics awaiting research, and well deserves careful reading whatever views are held on dyslexia. There are some rather startling assumptions and occasional decoding difficulties but these do not detract from the worth of this book as a source of discussion and reference.

ALICE F. LAING.

BLACKMAN, S., and GOLDSTEIN, K. (1971). *An Introduction to Data Management in the Behavioural and Social Sciences*. Chichester: J. Wiley and Sons, pp. 104, cloth £3.75, Paper £2.75.

COOLEY, W., and LOHNE, P. (1971). *Multivariate Data Analysis*. Chichester: J. Wiley and Sons, pp. 364, £4.50.

The two books present two different levels of approaching data analysis, although both are aimed at teaching techniques rather than theory.

With the ready accessibility of computers not only can more complex analysis be undertaken but many more people can perform such analysis. Most computer units have libraries of programmes commonly used by researchers. Blackman and Goldstein's book is an attempt to give the minimum information necessary to use a library programme on one's data. It is a very elementary text which might prove useful to complete beginners. The general information which it gives is possibly assumed in the specification of the library programmes which would also have to be consulted. However, a short talk to someone familiar with the local computer system would probably be as helpful.

Multivariate Data Analysis, on the other hand, is at a deeper level. Each technique is first described in an easy-to-understand fashion, followed by a number of illustrative examples and a Fortran programme which enables the researcher to apply the techniques to his own data with the minimum of difficulty.

A 50-page introduction on programming, statistics and matrix methods (only an elementary understanding of statistics and algebra is assumed on the part of readers) enables the book to be relatively self-contained. This is followed by two main sections depending on whether the data are being considered as coming from one or more than one population. The core method of the first section is naturally that of principal component analysis. There is also an introduction to a selection of factoring procedures. Multiple regression analysis, canonical correlation and multiple partial correlation are also dealt with in separate chapters. In the second section the discussion centres on the multivariate analysis of variance models. This is extended to deal with factorial designs and analysis of covariance. Discriminant function analysis and other classification models are also discussed. The book ends with a statement of the rationale behind the authors' research interests. Their field of research is second phase longitudinal human development research (SPLHDR); 'second' because they are interested in the effect of personality traits on 'life adjustment' rather than the antecedents of personality traits. Because of their interests, data from project TALENT (a massive survey performed on American high school youth) is used in examples throughout the book and provides a coherence not otherwise present.

Blackman and Goldstein's book could probably be read by novices before obtaining any formal instruction. Cooley and Lohne's could form the basis for a course on multivariate data analysis, probably at a postgraduate level, or selected sections could be read to enable a researcher to solve a particular problem. If one were following the Blackman and Goldstein approach and using a library programme for a multivariate method of analysis, then one would be very well advised to reach the same level of understanding of this method as could be obtained by reading Cooley and Lohne's book.

RANALD R. MACDONALD.

BUTCHER, H. J., and PONT, H. B. (Eds.). (1970). *Educational Research in Britain*—2. London: University of London Press, pp. 287, £3.25.

Educational research in this country continues to be a growth industry employing more resources and covering a wider range of topics than ever before. None of us can hope to keep informed of every new development and so this second volume of review papers summarising recent and current work is very welcome.

The first three papers describe the work of educational agencies: the NFER, the Schools Council and the National Bureau for Co-operation in Child Care. While informative about the aims and structure of these bodies, some of the reports on research in progress have already been superseded by their own published results. Several papers very usefully summarise work on the teaching of modern languages, mathematics and religious education. Allied in interest, but not primarily subject-oriented are papers on university teaching methods, medical education and education for business and management. Four papers are concerned with topics that have a social/administrative basis: a historical review of the age of transfer to secondary school issue and a current study of this in Aberdeen, the Arts/Science dichotomy, compensatory education and delinquency. The final chapter is a very clear account of the economics of education.

Reading this collection from beginning to end, a task which few will need to emulate, leaves one feeling rather depressed about the nature of educational research. Everyone is working very hard, ploughing his own furrow and providing a great deal of useful information, but much of it is news, rather than science: 18 per cent of junior school teachers do not know how to begin teaching reading, 30 per cent of medical students live at home . . . One contributor, at least, was aware of this: "At first sight research . . . might appear to be thriving. But this impression results from the use of the term research to cover work which might be better designated as curriculum development, survey or innovation. This umbrella usage tends to obscure the fact that controlled evaluative research . . . is rare." Equally sad is the apparent lack of recognition that specific problems in one area have many similarities with those elsewhere. For instance, work on training medical students is not seen to have much in common with university teaching methods in general and workers in both these areas seem unaware of the more efficiency conscious and imaginative work in the field of management studies, where the concept of 'continuing education' could certainly have relevance to teacher training in general. Yet everyone is asking but not attempting to answer the same fundamental questions: "How do we learn, how do we decide what to learn and teach and by what criteria should we judge the results?" Until this basic question is tackled there will continue to be, as one contributor put it, "intellectual confusion on many fundamental issues."

In spite of these reservations, each chapter in this book does provide an excellent summary of current work. Extensive bibliographies can be found for each chapter at the end of the book and these alone would justify its place in any education library. It is to be hoped that, when using the book as a reference in one area, the reader will take time to read in a neighbouring field.

EVA HOLMES.

EYSENCK, H. J. (Ed.) (1971). *Readings in Extraversion-Introversion*. Vol. 1—*Theoretical and Methodological Issues*, pp. 416, £4.00; Vol. 2—*Fields of Application*, pp. 355, £4.95; Vol. 3—*Bearings on Basic Psychological Processes*, pp. 640, £6.75. London: Staples Press.

The first of these books on extraversion-introversion is concerned with the theory and methodology of the subject. The 33 readings range in date from 1929—1967 with the majority in the late sixties. Most are very well-known to workers in this field and it is pleasant to have them so readily available.

The first two papers by McDougall and Gilliland predate the Eysenckian notion of introversion and extraversion which comes in with a bang in chapter 3. From then on except for Gray's very useful paper on the Russian approach to this subject—strength of the nervous system, equilibrium and dynamism—Eysenck's concept of extraversion-introversion as measured by the EPI largely predominates, although there are three papers dealing with the work of Guilford, Cattell and Jung. The present reviewer feels that this imbalance of contents is a weakness in what is otherwise a thorough survey of the area. Another anomaly is the length of the section on response sets to which five papers are devoted. After all, response sets are not peculiar to extraversion-introversion or to the EPI. However, despite this cavilling, by the end of the book the reader must emerge with a sound knowledge of the Eysenckian concept of introversion.

The second volume deals with fields of application. Here we find sections on education, vocational training, social psychology, psychiatry and crime. As with the last volume the majority of readings are concerned with the EPI or MPI. A few, however, use the Cattell tests (one indeed by Warburton uses Objective Tests) and one or two pre-war papers are included.

As is to be expected in the applied field the standard of papers is widely variable. Many of them simply report results the interest of which lies in the sample used, psychiatric, social or educational. Indeed this volume illustrates the dangers of having an easily used test such as the EPI. There is a strong temptation to give it to ever more exotic samples. Personality and the persistent non-swimmer is one which takes the eye in this volume. The section on education is concerned with the old chestnut—personality and academic success. Ten papers go to show the importance of extraversion-introversion and (irrelevantly) neuroticism. Only one of these papers hints at the complexity of this relationship. This highlights a weakness in this second volume. The readings are mainly such that the importance of extraversion-introversion as a personality variable is stressed and the efficacy of the EPI emphasised. Indeed, this whole book may be regarded as a paean of praise for the EPI which makes so many useful discriminations in so many fields.

The third volume, on the other hand, deals with the relation of extraversion-introversion to 'basic psychological processes.' In fact, this means that we find sections showing the importance of the factor in physiological processes, sensory stimulation and deprivation, perceptual processes (visual, auditory, aesthetic and even extra-sensory just to show the scope of the EPI), motor performances, and, finally, conditioning and learning. As befits so prodigious a field this final volume is a very large book—64 papers running over more than 600 pages.

Paradoxically this reviewer felt that this volume was not big enough—too much has been compressed into it so that there is inadequate coverage of some of the sections. For example, personality and conditioning is crucial to much of Eysenck's theorising especially as it impinges on vital social problems such as crime. Here, then, we should hope to find the evidence, unequivocal and clear, that conditionability is influenced by extraversion. Yet instead we find studies merely demonstrating that the conditionability of the eye-blink and the GSR is related to extraversion. Sceptics remain to be convinced that conditionability is a unitary factor and that the choice of the eye-blink response is not in some way symbolic. Nevertheless, this third volume is an extremely useful collection of source references on a wide variety of topics.

By whom are these three books to be used? If by undergraduates they suffer from a somewhat lopsided approach. Eysenck first, the rest nowhere. On the other

hand for personality researchers they represent a highly convenient set of papers which give a blanket coverage of the field, a useful companion to, say, Cattell's collection *Social Psychology*.
PAUL KLINE.

FERRI, E. (1971). *Streaming: Two Years Later*. London: NFER, pp. 114, £2.10.

This is the third report of the NFER's studies of streaming. In previous studies Mrs. Barker Lunn reported on the academic performance and attitudes of a group of streamed and unstreamed junior school children up to the age of 11. The present volume studies some of the children for the next two years following their transition to secondary schools.

The first table shows that the children from streamed junior schools did rather considerably better than those from unstreamed in the 11-plus examination (17 per cent passed into grammar schools as against 13 per cent). This is perhaps paradoxical in a study which has continually been at pains to stress the irrelevance of streaming for academic attainment. Whether the superior achievement of the streamed children was because they had been better taught, came from higher social class homes, or were more intelligent, cannot be determined. It is one of the most serious weaknesses of this series of investigations that the children were never given a non-verbal intelligence test, nor were the streamed and unstreamed children properly matched for their parents' socio-economic status. In the absence of these controls, believers in streaming will have some justification in thinking their views vindicated by the better achievement of the streamed children in the 11-plus.

The present volume looks first at the academic attainments of children from streamed and unstreamed junior schools during their first two years at secondary schools. It emerges that those who had been in unstreamed schools tended to make greater gains in the subjects tested, namely maths/concept, maths/problem, English comprehension and verbal reasoning. Is this difference significant and if so why has it occurred? It is another unfortunate feature of this series of studies that the authors never give overall mean differences between the two groups of streamed and unstreamed children. Instead, the children are broken down into no less than 18 small subgroups of differing intelligence, social class and sex. This makes it impossible for the reader to see how great the overall differences are and what significance can be attached to them. Why is it necessary to break the group down into five socio-economic groups and three ability levels? Surely what we need primarily are the single over-all means of children from streamed and unstreamed schools?

However, making the best we can of the results as presented, we see that the children who had been unstreamed in the junior schools tended to do better in the secondary schools than those who had been streamed. Mrs. Ferri hazards no guesses about why this should be and dismisses the result as being of little consequence. I suggest that the explanation is that the streamed children had had their attainment accelerated in the junior schools and the unstreamed had been held back. At the secondary stage, the two groups tended to level out as the beneficial effects of streaming wore off. This interpretation is supported by the result that almost all the deterioration of streamed juniors in secondary schools occurred in maths. There was no deterioration in English comprehension or (except for one sub-group) in verbal reasoning. The reason for this is probably that attainment in English comprehension and verbal reasoning are less affected by efficient teaching than attainment in mathematics, since they are largely tests of general intelligence.

Mrs. Ferri next considers the effect of streaming and non-streaming in the secondary schools. She takes the reading scores at 10+ as the base on which to measure subsequent achievement. No details are given of the reading test, and one wonders why a reading test was used. Surely a non-verbal intelligence test is the obvious test to use as a base for subsequent attainment? Continuing the argument, Mrs. Ferri finds that there is little overall effect of streaming from ages 10-12. As usual, no overall mean differences between streamed and unstreamed are given

Instead the results are presented for numerous subgroups (40 in this case). This makes it difficult for the reader to evaluate the results. Another difficulty is that the unstreamed schools put their children in sets for maths and English, the two subjects tested in the inquiry. Thus this part of the study is in effect comparing one system of streaming with another. In view of these weaknesses, supporters of streaming should not find themselves greatly disconcerted by the finding that there are no differences between the two systems.

The next part of the inquiry is concerned with tests of divergent thinking. A test was constructed which asked for the number of uses to which various objects (balls of string, barrels, etc.) could be put, and also attempted to measure other types of divergent thinking. Mrs Ferri states that the results produced some evidence that there is more divergent thinking in unstreamed secondary schools.

It is surely time for someone to voice the suspicion that these tests of so called divergent thinking, sometimes even called creativity, are really tests of silliness. They are scored for fluency (the number of responses the subject gives) and for originality (which is the number of responses which hardly anyone else can think of). Thus, you get high scores by thinking of a lot of really silly things, things which are so silly that no one else thinks of them. This is no doubt why older children get lower scores on these tests than younger children—as they have grown up a bit they have become less silly. Perhaps this is why streamed children get lower scores than unstreamed on these tests.

The next section is concerned with children's attitudes to themselves and to school. The first test is a questionnaire to measure 'academic self-image' and showed that children who went to grammar schools scored lower than they had in their junior schools. The questions were of the type "I'm very good at maths." It is perhaps not surprising to learn that children who went to grammar schools from unstreamed junior schools showed the largest drop in scores.

Mrs. Ferri professes much concern at this turn of events. "Their confidence in themselves" has apparently been "seriously undermined" and the 11-plus selection had had a "deleterious effect on pupils' attitude development." The book's dust cover describes the results as "devastating." These solemn words are surely rather ridiculous. What has happened is simply that the children had moved out of the child's world of the unstreamed junior school and into the more adult world of the grammar school. For the first time in their lives they have met their intellectual equals. In the streamed grammar schools they have discovered that there are many other children as clever as themselves, and some who are cleverer. They have abruptly ceased to be the rooster in the farmyard.

This is a discovery that we all have to make sooner or later. It is part of the process of growing up to learn what kind of a person one is and most children surely face the discovery that they have certain limitations with resilience. It is doubtful whether any great service is done to a child by trying to shield him from this self-knowledge. Indeed, one of the arguments for streaming is that it teaches the more intelligent children a certain amount of intellectual humility and, by implication, the lesson that they have to do some work if they are to keep up among their intellectual equals. The effortless superiority of the clever child in the unstreamed comprehensive is a poor preparation for the real world that lies ahead.

Mrs. Ferri concludes that she has found that whether or not children were streamed "bore little relationship to academic progress" and that, therefore, school policy on streaming should not be based on academic considerations. It should be based instead on its 'deleterious' effects on attitudes. Neither contention stands up to examination. In spite of the claims of the authors of this series of studies, the fact is that children in the streamed primary schools have done consistently better academically. The onus is on the authors to show that this is not an effect of streaming. And on the non-academic side, the aim of the NFER authors is apparently to cocoon children from knowledge of the kind of person they are for as long as possible. It is questionable whether an undue prolongation of the Peter Pan world of childhood is in the interests either of the children or of the society they are eventually to serve.

RICHARD LYNN.

FRANKENSTEIN, C. (1970). *Impaired Intelligence. Pathology and Rehabilitation*. London: Gordon and Breach, pp. xii+244, £5.75.

The intention of this book seems worthwhile. The author says he wishes to ask the following questions: What are the essential characteristics of genuine feeble-mindedness and how are they modified by the factor of personality types? How do these essential characteristics differ from cognitive patterns in secondary retardation?

The author's answers to these questions form the first part of the book. The second part discusses the role of the school in the rehabilitation of intelligence.

The two parts can be read independently and, in fact, the first three chapters were originally articles published elsewhere some five years ago. These are completely theoretical in that there is no empirical justification offered in support of sweeping generalisations. One finds oneself floundering in a sea of speculations, presented as facts. For instance, the first two chapters are concerned with the 'genuine feeble-minded.' These two chapters are littered with statements like: "It is safe to say that the feeble-minded can *never* learn abstraction" (p. 12); "Imagination does not fulfil in his life the functions it fulfils in the life of every normal child" (p. 13); "We, therefore, maintain that he does not pass through a period of oedipal conflicts, either at the age at which a normal child experiences them or later" (p. 38); and so on and so on. And one should note Frankenstein's description of the children he is talking about: "not the lowest grades of idiots and imbeciles" but "those cases of feeble-mindedness we have in mind here are children whose IQs, could we establish them more or less reliably, would range between 50-60 and 70-80" (p. 24)—our ESN population, in fact!

Also in this section is outlined a typology of feeble-mindedness in terms of 'aggressive,' 'suspicious,' 'submissive' and 'apathetic' and distinctive behavioural patterns are proposed. Again, no evidence for its validity is offered.

The second section is concerned with 'secondary education' and the author distinguishes 'social' and 'cultural' secondary retardation. Again, generalisations are made with no empirical evidence to back them. The third and longest section dismisses the part that schools have to play in the rehabilitation of intelligence, in cases of secondary retardation and one does not have to accept the earlier theoretical discussion to get some insights from this part. This part is the least unacceptable.

It is surprising, in a book written by an authority in the field of special education, that so many of the references are to texts published some years ago. Apart from his own publications, only three of the 58 references are to work published since 1960. This makes for unfortunate gaps in the coverage of certain key topics. For instance, in a long section on the development of the feeble-minded, there is no mention of the work of Inhelder and Woodward in the application of Piagetian concepts. In the important area of language, there is no mention of the work of the Russian psychologists, of O'Connor, Hermelin, Lyle, Mein, etc., in this country, or of any recent American work. In the discussion of 'social' and 'cultural' retardation there is no reference to the work of Vygotsky, Bernstein and so on. There is no hint that a factor analytic approach might have something to say about the structure of intellect in the feeble-minded.

This reviewer could not recommend this book to any of his students, either at graduate or post-graduate level. Nor would he recommend it to teachers interested in the field of special education.

DAVID EVANS.

GOODACRE, ELIZABETH J. (1971). *Children and Learning to Read*. London: Routledge and Kegan Paul, pp. 114, cloth £1.00, paper 50p.

The depressing findings about the extent of reading disability that have been brought to light in several surveys have given rise to an increased concern about the

teaching of reading. As Goodacre notes in her first chapter the past 20 years have seen a movement away from the formal teaching of reading, engendered by a somewhat mystical belief in spontaneous learning, and it is not too unreasonable to assume that the related lack of training for teachers in the teaching of reading that followed in the wake of this has contributed to the alarming spread of illiteracy in the schools. In so far as Goodacre's book is intended to counteract this trend, it is to be welcomed.

The author uses a Piagetian analogy to describe her analysis of the state of reading research, arguing that most British research has been at the 'concrete operations' stage, dealing with materials such as 'words in colour,' diacritical marking, i t.a., etc. She then suggests that it should move towards the 'operational stage' and become concerned with reading processes. Her book is obviously intended, as a step in that direction since it is primarily concerned with the relations between the child's abilities and the task of reading. In some ways this is a weakness, since it leads her to ignore the interactions between child characteristics and orthographic factors that have been documented in the literature.

The first two chapters are sketchy outlines of learning theories and Piaget's stages of cognitive growth. These chapters are so brief—two-and-a-half pages deal with behaviourist theory, insight theory, and perceptual theory—as to be of doubtful value. The third chapter, on methods of teaching, is far more useful for its intended audience. The various methods are described lucidly with careful documentation of the benefits that have been claimed for the various methods. This chapter is followed by a very brief discussion of linguistics and the teaching of reading, which fails to bring out precisely what linguistic researchers have been saying, and more surprisingly fails to mention the 'Breakthrough to Literacy' programme that incorporates many of the points that she is trying to make. The final three chapters, dealing with the development of visual and auditory perception, and with specific reading disabilities, are by far the meatiest sections of the book. The discussions are clear and lucid, and refreshingly up to date, and present the reader with the very necessary understanding of these important elements in reading skills.

Overall the book is worthwhile, and should be recommended to those concerned with the teaching of reading. Goodacre's own personal wisdom as a teacher is evident on almost every page, and her experience coupled with her research knowledge leads to a multitude of practical and practicable suggestions. The weaknesses of the book stem from the space restrictions that the publishers presumably imposed, and it is a pity that the author did not respond to such pressure by a reduction of coverage.

JOHN GARNER.

GULLIFORD, R. (1969). *Backwardness and Educational Failure*. Slough: NFER, pp. 110, 50p.

FURNEAUX, BARBARA (1969). *The Special Child*. (Penguin Education Special), Harmondsworth: Penguin Books, pp. 208, 30p.

Gulliford's book aims to help teachers "who wish they knew more about the learning difficulties they meet." The aim is certainly achieved in a brief, but comprehensive survey which ranges from chapters on definitions and causes, through the examination of difficulties in reading, mathematics and other subjects to a final glance at educational provisions and teacher training. The treatment is generally up-to-date and the reader is introduced to much of what is valuable in research in this field, without being swamped with references. At the same time, there is a useful bibliography and lists of suggestions for further reading. A keen reader will come away much more aware of the complexities of this field and with many useful insights, but the inexperienced teacher coming to it for classroom help will leave it somewhat disappointed. But this is no real fault of the author's:

given his remit he has produced a most useful introduction to the field. Where he does seem a little lacking is in immediacy and enthusiasm. Sentences beginning with "One wishes that it were possible . . ." or "It is easy to assume mistakenly . . ." will fire few imaginations.

This last criticism certainly cannot be levelled at Barbara Furneaux. Here is a writer deeply committed to her subject. Perhaps pardonably, therefore, both writing and coverage are uneven. Essentially, the book deals with the disposal of mentally handicapped, autistic and ESN children, focusing on weaknesses in the system of hospital, junior training centre and special educational provision. The approach is personal and use is made of brief case descriptions.

Some issues are not dealt with satisfactorily. Thus, the differential diagnosis between autism and subnormality is over-simplified, or rather, taken for granted, and far too optimistic a prognosis is held out for autistic children. The level of writing is erratic: psychologists will be somewhat taken aback by a treatment of IQs which mentions only the Binet test and takes mental age scoring for granted, yet the layman is left with no idea of the *content* of an intelligence test. Similarly, the researches quoted seem arbitrary, especially by comparison with Gulliford, who has clearly decided what to offer out of a comprehensive knowledge of his field.

Nevertheless, for the concerned parent or the student looking for a real 'feel' for this field, Mrs. Furneaux has much to offer—especially for those who will then go further.

The Special Child has no index and really needs a glossary. Both books could have been better proof-read.

ASHER CASHDAN.

HAYNES, J. M. (1971). *Educational Assessment of Immigrant Pupils*. London: NFER, pp. 121, £2.00.

Problems of intellectual subnormality and of specific learning disabilities occur at least as frequently among immigrant as among indigenous children in the schools of this country. But educators and the psychologists whom they consult are ill-equipped to distinguish educational backwardness which originates in these conditions from the consequences of unfamiliarity with the English language, of early exposure to different artefacts and symbols, and of different styles of approach to imposed tasks in schools. In order to assess the present psychological attributes of a child from an immigrant family, one needs instruments that are not dependent upon the English language, that are measures of learnings which are highly relevant to basic educational skills, through a wide range of abilities, that present the child with tasks which engage his interest and attention, and that are so constructed as to leave no doubt in the tester's mind that the task has been understood. When one attempts definition of these desirable test characteristics one realises that they are not peculiar to the context of the immigrant pupil: they are what are required in the assessment of varieties of learning problems for which conventional 'intelligence' tests are not very suitable tools. Some parts of this book will interest educational psychologists for whom the problem of immigrant pupils is not a high priority.

The work is a report of a two-year study, carried out about four years ago, of 125 Punjabi-speaking Sikh children resident in a London borough and attending first-year classes in a number of junior schools. About a half of the sample had attended schools in this country for less than two years. They were compared with 40 English children from the same district and attending the same schools. The project was financially supported by the Leverhulme Trust and conducted under the auspices of the National Foundation for Educational Research. It is a good, detailed, technical report on the research methods and findings.

A great many variables were examined, including (a) information on each child's background provided by the schools; (b) school and teacher characteristics (a scale to assess differences of attitude among teachers towards Indian children is reproduced); (c) conventional cognitive tests; (d) tests of learning ability developed within the project; (e) criterion measures of educational attainment. The tests of school attainment which were used as criteria and as measures of predictive validity, seem to be very formal and limited in scope. Other criterion tests, EPVT and WISC Vocabulary, one would not normally consider to be measures of attainment; they were employed to test understanding of the English language, and of these it might be thought also that a broader view of language learning would have been desirable.

The tests of Learning Ability are original to this research; its principal aim was "to devise a new type of test . . . to assess the learning abilities of children with all degrees of linguistic and other cultural handicaps." One Verbal test requires the subject to learn unfamiliar names of common objects; a second Verbal test involves serial rote learning of nonsense syllables. The Analogies test employs simple geometric figures; the subject draws his response. The test of Concept Formation requires the subject to classify sets of objects by various attributes. In the test of Number concepts, which does not use spoken words or written symbols, numerical series have to be completed with use of 'Structa' Arithmetic Apparatus. There is evidence, from the English as well as the Indian subjects, that the Learning Ability tests are better predictors of performance on the criterion measures than conventional intelligence tests. An appendix contains detailed description of the materials, administration procedures and scoring. It seems odd, therefore, not to offer us the means and standard deviations of the scores obtained on these tests and the other major variables.

Very many variables were examined for the part which they may have contributed to the results, including size of class, length of teachers' experience, etc.; among these is the interesting finding of a trend to more favourable attitudes towards Indian children among teachers from schools having the larger proportions of immigrant children.

This book is essential reading for all those involved in the psychological assessment of children who are handicapped, under-privileged and failing to respond to education, as well as those who are concerned with children from immigrant families.

C. J. PHILLIPS.

HAYWOOD, H. C. (Ed.) (1970). *Socio-Cultural Aspects of Mental Retardation*. New York: Appleton, Century Crofts, pp. 797, \$8.

Some would have it that what matters at a conference is the informal discussion and the contacts made; others expect a report or end-papers to take away as tangible proof of having got something out of it. Americans seem to wish to make a book even years later.

This book consists of the collected papers of a conference held at Peabody College in June, 1968, and 38 people contributed, four of them from England. How does one review such a book? It is normal to say that some papers are better than others—but of course! All that is possible is to try to group the themes and to some extent the editor, who was also the conference director, has done this for us. One paragraph of a letter from Lyndon B. Johnson, which is published as a frontispiece, says: "We have come to recognise that up to three-quarters of the mental retardation in this nation is associated with conditions of life that blunt and cripple the development of the human intelligence." There is surely material for considerable argument here!

Any social-cultural conference is greatly influenced by the immediate events in the host country and the negative forces in American society were at that time much in evidence. The predictions of 1968 with regard to black power, integration, youth revolt, Vietnam and the strength of the dollar, have not been fulfilled in 1971, all this in itself being an indication of the difficulties in social-cultural themes.

The main considerations of this conference were: intelligence—its nature and genetic, social and cultural aspects; language, its origins and development; the roles of family, home and school and social institutions in the development of the individual; the significance of the mentally retarded group economically to the nation; the relationship between retardation and social class; emotional imbalance and physical handicap and, finally, how negative cultural forces can be reversed as they are so much associated with progressive retardation. The agreed identification of 'negative cultural forces' in this country has been a matter of considerable dispute recently.

There are eight sections in the book, excluding the summary, two being on cognition, one on social institutions, two on education, one on cross-cultural perspective, one on handicap and one on culturally related biological factors. The English contributions are on education and on the role of social institutions. There is considerable variation in the length of the contributions but in almost every case they affect the review style, usually with large numbers of references. One of the longest contributions is on language acquisition and cognitive development. It could have been shorter if it had not chosen to range from the elementary to the profound. On the other hand, again within the language section, there is a piece on the Peabody Language Development Kit which will be of little help to anyone trying to use it except to convince him that the manual is not a good one. A brief examination of the manual would have told him that in any case.

Regrettably, there is no clear decision pointed upon what action should be taken in our society for dealing with the mentally retarded regarding prevention and treatment. This may be acceptable academically but is frustrating administratively. There is a clarion call to reduce poverty. Amen to that.

Readers working in this field can select an area of particular interest to them and usually find it very adequately reviewed while giving references to further information. One cannot reasonably expect more from conference proceedings.

J. G. MORRIS.

KAHAN, V. L. (1971). *Mental Illness in Childhood*. London: Tavistock, pp. 219, £3.00.

This clearly written and extremely interesting book is an account of a new form of treatment given to a number of children suffering from psychoses, subnormality, conduct and personality disorders in a 'family-based' residential unit, which had once been a small conventional subnormality hospital, during the years 1959 to 1965. What the author describes as "child-centred intensive care," i.e., "the provision of infant nurture, affection, tolerance, and structure according to the patients' human needs," was used to provide an atmosphere of support in which therapeutic measures known as 'regressed nurtural care' might have some chance of success. This consisted of providing through play groups an opportunity for the therapist to establish a personal emotional contact, at any level required, with the patient and thus attract him into more constructive play, achieve more successful toilet control, and develop speech.

The book is presented in two parts, the first 100 pages describing a research study examining the effects of this treatment on 71 such children, and the second 100 detailing perhaps overlong case histories of 16. While describing in great detail the symptoms, etiology and general familial background to the children's psychiatric conditions, this reviewer feels that the author does not give enough space to the psychological theory behind the adoption of these particular therapeutic measures.

The 'family-based' unit supplying tolerance, love and affection to ward off the detrimental effects of emotional deprivation is a familiar enough sight nowadays in orphanages and such-like institutions but as practically the sole treatment for severe cases of autism, subnormality and conduct disorders it needs a stronger argument presented in its favour.

Unfortunately, the numbers in the study were relatively small, making any worthwhile statistical analysis impossible, and there was a certain amount of selectivity in the cases referred to the hospital. The author quite rightly recognises this, and draws only tentative conclusions as to the effects of his treatment on his patients, realising that they have to be weighed against any maturational changes which might have occurred anyway. Nevertheless, the response of certain categories of children to the treatment was quite remarkable and cannot fail to impress. 15/21 of the psychotic children were able either to return home and attend school or a training centre, or were likely to do so in the near future, as were all 18 of the children suffering from conduct disorders. The study will have to be repeated with many more children, however, before the case can be found to be proven.

All in all the author has presented a very readable research report, certainly one which is bound to stimulate further interest in the therapeutic potential of the total environment in the treatment of childhood mental illness.

J. C. McQUOID.

KIELL, N. (1969). *The Universal Experience of Adolescence*. 2nd edition. London: University of London Press, pp. 942, £6.25.

This fat volume should be a good test of the reader's enthusiasm for the theme of adolescence. Its 500 passages on diverse aspects of adolescence are culled from some 200 biographical sources, covering a wide historical and geographical range—St. Augustine to Anne Frank, Robert Burns to Jawaharlal Nehru, Maria Choma (a Papago Indian) to Simone de Beauvoir. As an anthology it may be convenient to dip into in the library even if it defies sustained reading. The selections are grouped under 18 headings, such as psychosexual characteristics, the conflict of generations, the peer culture, the influence of teachers, and vocation and identification. The underlying theoretical attitude is broadly psychoanalytical and the explicit thesis is, as the title suggests, that adolescence is not a purely relative concept but one embracing psychological phenomena common to most times and places.

Professor Kiell's work is a valuable corrective to extreme sociological or anthropological relativism, or to the surprisingly widespread naïveté that sees the generation gap or the identity crisis as unique contemporary phenomena. His illustrative readings tempt one to a wider historical and international perspective on the psychology of adolescence. At the same time the sheer volume of this illustration obscures some serious problems about the argument. The limitations of biographical evidence are frankly discussed, but it is doubtful whether objections to its unrepresentativeness are really answered by the plea that quite a few 'ordinary' people are included in the sample, and that even 'extraordinary' people tend to be unextraordinary in adolescence and, therefore, acceptable as typical cases.

Any characterisation of adolescence has to struggle with large numbers of variables of different kinds, with the problem of estimating at least crudely the way in which adolescents are ranged across any of these variables, and, perhaps most controversial of all, with the question of what evaluative standpoint one occupies. There is unlikely to be any one final view of adolescence. Even if all empirical methods were (improbably) clear, varying practical purposes would influence whether one chose to fix one's sights on 'the universal experience' or perhaps on the agonising idiosyncrasy of a particular situation confronting one. But the universal experience should certainly be looked at for some of the time and this book may help people to achieve that perspective.

H. S. N. McFARLAND.

MACKENZIE, N., ERAUT, M., and JONES, H. C. (1970). *Teaching and Learning: An Introduction to New Methods and Resources in Higher Education*. Paris: UNESCO, pp. 209, £1.05.

This outcome of a Unesco inquiry might well have been a dull though useful factual survey, but its authors were fortunately given their head and allowed to use the findings of the inquiry "as the starting point for a more intensive study." The result is the best book on the new shape of higher education that the present reviewer has yet come across. It is solidly based, drawing on the whole world for its examples, but it never allows factual details to obtrude, using them only to illustrate its general line of thought. The thought is forward-looking, profound and admirably structured. Inevitably there is a little repetition since so many of the important concepts are relevant under several different chapter headings, but on the whole the working up of this complex subject into a continuous, logical and interesting exposition represents a creditable achievement.

The main ideas, familiar enough already in scattered writings but not previously so well integrated and focused on higher education, may be summarised baldly as follows: "The university began in a cloister, but it has become an arena." There has been a student number explosion, a knowledge explosion and a costs explosion. Problems abound, but the new technology of education offers solutions. Shift the emphasis from teaching to learning; adopt an empirical approach; concentrate on *resources* for learning, especially on building up libraries into integrated resource centres; develop the art of management, both of existing resources and of continuous innovation. Almost all these concepts are alien to the traditional university outlook, but opposition must be overcome, since "the position has to be accepted that the *status quo* is not on the list of choices open to us." Among the most important implications of the new outlook are a strong emphasis on independent study, an upgrading of 'development' as being even more vital than 'research,' and the transformation of non-interfering administration into creative management.

The book displays insight and integrity throughout. On the one hand it does not hesitate to designate something as essential even though it is wholly unconventional, and on the other hand it unerringly separates what is genuinely promising from what may be fascinating but has an uncertain future (e.g. 'because it costs too much'). Among the many examples of special perceptiveness we may mention the selection of the 'course' as the unit ripest for the new treatment, and the criticism of our obsession with the time factor in learning. On the other hand, it may be that the authors do less than justice to some of the traditional university attitudes which they expose so mercilessly as having 'attitudinal but not operational significance.'

The style of writing is clear and incisive and bibliographies are extensive.

STANLEY NISBET.

MORRISON, A., and MCINTYRE, D. (1971). *Schools and Socialization*. London: Penguin Books, pp. 240, 40p.

The authors claim that their book is about "the agencies, practices and processes involved in socialization and, in particular, about the ways in which schools and other educational institutions, through their teachers, curricula and organisation, deliberately or incidentally influence the young." While directing their main attention to schools and students, they rightly assert that it makes little sense to discuss the influence of schools in isolation from the other agencies of socialization including parents, neighbourhood and peer groups. Nor can these agencies be considered independently of one another for the effects of school cannot be the same for every individual as the effects of family and community experiences interact in complicated ways with response to school. By adopting this viewpoint the authors claim to put educational influences in their proper perspective.

Bearing in mind the limitations of space imposed by Penguin-sized pages, these claims could only be achieved by the adoption of a highly selective attitude to the vast field of literature that could be held to be relevant. The first limitation which the authors imposed was on the areas of socialization. Four major areas are discussed: academic achievement, social behaviour, political attitudes and occupational choice. In the first of these the influence of the home and the school are considered. There is, however, little material in this chapter that cannot be found in many other texts. Surprisingly, too, there is no mention of the work of Himmelweit and Swift who have presented a model of the school as an active socializing agent. This is particularly difficult to understand as this work is British in origin as distinct from the majority of references which are American.

The other three sections, however, present much material which is seldom encountered in educational or social psychological texts. It is difficult to be specific about content in this review because of the wide coverage of the book but some general headings can be given. In social behaviour four general areas are covered—experimental work on social influence, the development of 'morality,' interaction in small groups and the perception of self and others—before educational influences are considered. Two topics are covered in the section on political attitudes—the development of awareness, orientation and information about the political system and inter-group attitudes. In these two sections there is thus much that is basic to informed discussion about social aims in education. In the final section, personal characteristics and background experiences are examined in relation to occupational choice. Developmental theories of how occupational choices are expressed and an examination of the factors, including school curricula, which actually determine, occupational choice are then discussed. The degree to which these considerations together with the way in which career guidance in schools is conducted in schools, place severe constraints on the rationality of occupational choice can thus be seen.

In each of the sections, the material is presented in such a way that the gulf between theoretical and practical knowledge is made explicit. This is, in the reviewer's opinion, one of the major achievements of the book. It makes clear that to have well-meaning intentions is a far cry from the realisation of these intentions. This paragraph, taken from the social behaviour chapter is a typical example of the refreshing tone of the book . . . " Limited knowledge is equally disturbing when it is shown by educationists and others who advocate major educational policy changes on the grounds that they will lead to significant alterations in the social skills, values and interaction of the mass of pupils and subsequently of adults. Such changes concerned, for example, with school organisation or selection procedure, may be introduced with only shreds of evidence, especially on long-term effects, to support them, and in ignorance of facts about social processes which suggests that there are powerful constraints upon the effectiveness of adult-initiated changes." The chapters on social behaviour, political attitudes and career choice, all grossly neglected as far as evaluation is concerned, are particularly valuable in this respect.

It is, of course, easy to make criticisms of a book which attempts so much in such limited space. There is, for example, no integrating framework into which the various sections can be fitted. This leads to some overlaps, such as the similar brief references to the various processes of influence made in the chapter on social behaviour and political attitude. Objections could be raised about the high degree of selectivity employed in relation to some fields of the literature. In the sections on attitude change and cognitive development this seemed particularly marked. But bearing in mind the difficulties which confront anyone who attempts a book of this kind—the structuring and organisation of a great deal of literature, the incompatibility of different theoretical positions, the degree to which generalisation is legitimate particularly from laboratory to applied situations—these defects are understandable.

Accordingly, this interesting and readable account of some aspects of the literature of social psychology which is highly relevant to a great deal of educational discussion yet which is all too frequently totally neglected in colleges of education, is to be warmly welcomed. At the same time, it should be appreciated

that, by itself, the book would be inappropriate as a basic text for students. Concepts such as 'attitude', 'belief' and 'value' are not dealt with in any systematic way and notions such as 'personal ideology' are introduced without any attempt to define them. More statements of the kind 'more detailed accounts are available elsewhere' together with appropriate references would have increased its usefulness. If, however, it stimulates workers in education to widen their horizons and to reconsider the role which social psychology might play in educational discussion, it will have done a great deal.

D. S. FINLAYSON.

PIAGET, J., and INHELDER, B. (1971). *Mental Imagery in the Child: A Study of the Development of Imaginal Representation*. London: Routledge and Kegan Paul, pp. xix+396, £3.50.

This is the English version of *L'Image Mentale Chez L'Enfant*, which first appeared in 1966. Piaget's active interest in the subject is relatively recent, although his radical conception of mental imagery is apparent as long ago as 1947 (*La Psychologie de L'Intelligence*) where he states, "The mental image is not a primary fact, as associationism long believed; like imitation itself, it is an accommodation of sensori-motor schemata, i.e., an active copy and not a trace or a sensory residue of perceived objects." Further discussion of the subject is to be found in the *Mechanisms of Perception*, published in French in 1961 and in Vol. VII of *Experimental Psychology: Its Scope and Method*, published in French in 1963. This latest book contains the fullest account of his ideas and detailed descriptions of the empirical work of his 24 collaborators.

English-speaking psychologists are accustomed to think of mental imagery in terms of individual differences in its sensory or verbal form, its vividness, controllability and so on. While Piaget acknowledges that for some people introspection may naturally afford imagery experience of a percept-like quality he denies that such experience can form the basis for a universal classification. In contrast to the notion of images as attenuated forms of perception, copies of reality, the elements from which thought is constructed, Piaget considers images to be an imitation of perception, by which he means an active internalised reconstruction of perception.

He therefore proposes a classification based upon its structure rather than its content. It is important, too, to realise that this proposed classification has a primarily geometric and spatial reference. The categories in this classification are based upon the following. First, he distinguishes between reproductory images (i.e., images of things already known and perceived) and anticipatory images (i.e., images of things not previously known or perceived) though, admittedly, the distinction may be hard to maintain in practice. Reproductory images may be immediate (i.e., images of what is perceptually present) or deferred (i.e., images of earlier perceptions). Within these categories the images may be, as appropriate, of static objects, moving objects, familiar transformations (e.g., dividing a square into two equal rectangles) and unfamiliar transformations (e.g., folding a paper square twice into half then cutting a piece from the intersection of the creases and imagining what the unfolded paper would look like). Furthermore, concerning images of movements and transformations a distinction is made between images of the movement itself (i.e., the successive positions of the object or successive states of the transformation) and the final position the moving object reaches or the terminal state of the transformation. Finally, degrees of internalisation of the image are discussed depending on the methods used to ascertain them. Piaget considers that there are four possible methods: verbal description based upon introspection; a drawing by the subject; a choice made by the subject from several drawings prepared by the experimenter of the one best corresponding to his mental image; and reproduction by gesture.

Since it is Piaget's purpose to demonstrate a developmental sequence in the establishment of these various categories of images he relies mostly on the last three methods. The subjects range from 3 to 12 years of age, together with some groups of adults. The bulk of this lengthy work is taken up with the detailed exposition of the many apparently simple but often systematically ingenious inquiries carried out by his collaborators and with the elaborate discussions and interpretations of the results.

There are many interesting and unexpected findings. For example, it appears that images of movement or processes of transformation are not in evidence before the stage of concrete operations is reached; with anticipatory images, those concerned with the end state of a movement or transformation appear before those concerned with the movement or process of transformation itself. There is full discussion of the relationship, between imagery, perception and imitation, of the relationship between imagery and pre-operational and operational thought; of the symbolic nature of imagery; and finally, of the epistemological status of imagery in the light of these investigations.

The limitations of the book are clear. It is concerned solely with the relationship between imagery and intellectual operations and ignores the role of imagery in fantasy and creative thought. There is no attempt to accommodate the researches of others on visualisation and spatial ability. The book is difficult to assimilate both on account of the unfamiliar meanings given to otherwise familiar words and on account of the enormous amount of detail in the reports of the experimental inquiries. The descriptions of the latter, although always lengthy, are not always plain and may make replication of some of them dubious. The size of the samples used is larger than in previous investigations but there is no information about background variables, other than age, that may sensibly have affected the results. There are innumerable points of detail which deserve closer examination and further checks. Nevertheless, Piaget's fundamentally different conception of imagery and the exhaustive ingenuity of the inquiries seem bound, sooner or later, to exert a considerable influence upon traditional approaches to the study of mental imagery.

LAWRENCE LITT.

RUDD, W. G. A. (Ed.) (1970). *C.S.E. : A Group Study Approach to Research and Development*. Schools Council Examination Bulletin 20. London: Evans/Methuen Educational, pp. 264, £1.58.

A social system which permits and, indeed, requires social mobility is necessarily interested in individual differences and their assessment. The chief instrument of assessment in this country is the public examination system which has developed since the middle of the nineteenth century. Until recently, the methods of examinations have remained highly traditional; with a few notable exceptions there has been little examination of examinations. The last 15 years or so, however, have seen a welcome change: the examinations which have pervasive effects on candidates and their schools and on society at large have come under close scrutiny.

This change in attitude may be attributed to a variety of influences. The experimental work of some of the GCE examination boards, now supported by their research units, has begun to dispel the unjustified image of them as purely conservative, not to say reactionary. The training of educational psychologists by the universities has borne fruit: trained research workers have become available in more adequate numbers at key points such as the Schools Council, the colleges of education and the examining bodies themselves. The vast body of American research in mental measurement has offered suggestion and stimulus. The Nuffield projects of curriculum development and evaluation made a notable impact. The Department of Education and Science began to invest substantial sums of money in research. Other influences could also be discerned. One of the most powerful has been the institution of the CSE. The report edited by Dr. Rudd records one

notable enterprise in the development of this new examination, a group project directed by the University of Manchester School of Education.

The report is interesting as much for the project's 'group study approach' as for the 'research and development' itself. The project successfully engaged the participation of school teachers, college and university lecturers, HMIs, and others, and 'consultants' expert in research design and statistical inference played an invaluable role. As the late Stephen Wiseman said in his foreword, "the problem of securing the real involvement of working teachers in the research process (as opposed to erecting a spurious facade of discussion groups or committees behind which the research workers did the job) and at the same time achieving the necessary rigour in experimental design, in method, and in analysis" was successfully overcome. It was demonstrated that, as one of the test consultants puts it, research should inform practice, and practice may usefully direct research.

The members of the project team worked in panels concerned with the teaching and examining of art, English, French, mathematics and music. Concern with research and with development, respectively, varied considerably from group to group, development rather than research (in so far as the distinction is valid) predominating. The typical method was to agree on some formulation of the objectives of teaching, to devise pilot tests considered appropriate and to revise these in the light of experience and statistical analysis. The agreed statements of objectives in some cases probably concealed differences in aim. Much originality was shown by teachers in devising methods of testing and assessment, and the consultants applied objective criteria of the effectiveness of the methods. Several of the panels, notably the English and the music groups, carried this work considerably farther and have made distinct contributions to research. The English group, for example, employed reference tests (of fluency, flexibility and the like) and carried out a suggestive factor analysis of 52 variables.

The work of the project has played a useful part in the development of CSE syllabuses and examinations. The report, however, gives much food for thought about the future evolution of examining at 16+. The Schools Council has resolved that there should be "a single examination system at the age of 16+." This highly ambiguous decision may be given various interpretations. One naive interpretation would be that a single test (or set of tests) should be applied to all candidates in a subject and should result in grades describing the performances of candidates throughout 60 or 70 per cent of the 16+ age range. The report of the project suggests that ability or attainment at a lower level may be so different from that at a higher level as to be incommensurate with it, though each may be an appropriate objective for a candidate. Again, the project's English panel found that 67.9 per cent of the variance in its CSE English tests could be attributed to some 12 significant (Promax) factors. The description of a performance in such tests by a single grade in a 16+ examination would seem an unrealisable task. A profile of the performance would be more descriptive, but would present difficulties of interpretation to users. Other problems are suggested in the thoughtful 'retrospect' chapter with which Dr. Rudd concludes the report. Clearly research and development in examinations have a long way to go beyond this useful contribution.

R. A. C. OLIVER.

SOCIETY FOR RESEARCH INTO HIGHER EDUCATION (1970). *Research into Higher Education, 1969: Papers presented at the Fifth Annual Conference.* London: SRHE, pp. 78, £1.10.

This volume is no more and no less than its title suggests. There is nothing polished or complete or integrated about it: it consists of four somewhat rough-hewn interim reports, presented at a conference for discussion. The reports lack both the clarity and the finish that one would look for in a more permanent publication, and so one could not recommend them to the general reader, though fellow specialists in any of the same fields will certainly find much in them to think about and write to their authors about.

The first paper, *Supplementary Predictive Information for University Admission*, is by A. B. Sainsbury, the co-ordinator of the research project on the selection of university students which was set up by the Committee of Vice-Chancellors and Principals. Preliminary try-outs of a new form for headmasters to fill up when reporting on university entrants and of a new test of academic aptitude along the lines of the American S.A.T. are described and commented upon. The account as it stands is not very impressive but one can hardly judge a project still in its early stages.

The second paper, by Joan Brothers, is entitled *Residence in Higher Education: Some Findings from the Student Residence Project*, but it is in fact concerned more with principles of method than with 'findings.' Questions are asked like: What are the stated objectives of a particular residential unit? Does its structure support these objectives? Can we discuss what is the best size of unit without asking "best for what?" What is it like for a group to be confronted with a picture of themselves in the form of a sociological report?

The emphasis is again methodological in the third paper, *Forecasting Student Numbers in Higher Education*, by Alice Crampin. The shortcomings of the Robbins projections are scrutinised and improved methods, based on the follow-through of successive cohorts of 14-year-olds and incorporating calculated allowances for 'comprehensivisation' and for the shortage of science teachers, are demonstrated. The complexity of demographic prediction is convincingly shown, but there are some obscurities of presentation in the paper itself.

The last paper, by David Marsland, is called *An Exploration of Professional Socialisation: The College of Education and the School Teacher's Role*. In this longitudinal study each of a group of students was assessed, on 11 variables (mainly affective in character), at the beginning and at the end of a college course, and the differences were noted. It was found, for example, that the average student had become more progressive and less traditional in his educational outlook, but also that he had become less committed to teaching as a profession. Like the other papers, this is more a series of highly technical notes than a finished communication and the interest tends on occasion to be focused more on methodology than on the real situations which lie behind the figures.

STANLEY NISBET.

SUTHERLAND, M. B. (1971). *Everyday Imagining and Education*. London: Routledge and Kegan Paul, pp. vii+224, £2.00.

Imagining is a prevalent form of mental activity, yet the cultivation of imagination was denounced by Plato, Rousseau and Montessori and its use in the many phases of education is still a field for conjecture since empirical studies which suggest new directions continue to emerge.

The central theme of the present work is an appraisal of the role of imagery and imagination in the process of education. This is a very considerable task involving a survey of the wide field of empirical studies of imagining and their relationship to other forms of mental activity and the ever-present penumbra of moral issues, such as fears that any form of autistic thinking is potentially dangerous for the child and thence to consideration of one's basic philosophy of education. The intrinsic difficulty of the problem is further underlined by such facts that men as distinguished as Lord Kelvin could claim that he never felt that he understood a process unless he could make a model of it, and James Clerk Maxwell could state that while he was aware that many of his contemporaries were helped in their thinking by models and diagrams, he, on the whole, felt hindered by them.

The work under review deals with a number of relevant issues in a vast field, such as the important problems of definition, measuring and assessment of imagination, relationship to other kinds of thinking, everyday imagining and, of course, education and imagination. The several facets of each phase are very fully discussed, suggesting a long period of reflection by an author from a predominantly literary background. There is much that the practising teacher and educational

administrator could ponder; but, despite the magnitude of the task, the more psychologically orientated reader would welcome greater reference to more recent empirical studies not only of visual, but also of imagery associated with the other sensory modalities and particularly of auditory imagery and problems of synesthesia where such studies as those of Werner, Karwoski, Odbert and others have already indicated possibilities of significances for musical and literary appreciation.

F. V. SMITH.

WILLIAMS, N., and WILLIAMS, S. (1970). *The Moral Development of Children*. London: Macmillan, pp. 122, cloth £1.10, paper 60p.

In the years before 1930 studies of moral development were common in psychological journals. These studies were often based on the assumption that moral ability was unitary in the same way as intelligence. Tests, modelled on intelligence tests, were devised to measure moral ability. The analogy broke down with the publications in the years around 1930, of the three-volume Character Education Inquiry, which showed that moral behaviour tended to be situation specific. As a result, for the next 10 or 15 years moral development research was rarely reported in journals. After that quiet time, a new kind of study of moral development was increasingly performed. The distinctive focus of interest of this research was the relationship between child-rearing practices and laboratory measures of morality (usually concerned with guilt expression or resistance to temptation). The methods used by workers of this orientation were shown, in the early 1960s, to be unreliable. The publication in 1965 of Sears, Rau and Alpert's massive *Identification and Child-Rearing* may be held to stand in the same relationship (for different reasons) to the moral development research which preceded it as the Character Education Inquiry held to the research which preceded that. One reviewer wrote of the Sears, Rau and Alpert book that its major contribution would be to ensure that nobody did that kind of research again.

One can thus crudely (without certain important qualifications) distinguish two cycles of psychological research interest in morality this century, ending in something like disarray. A new approach is now adopted by some researchers, and particularly those associated with the Farmington Trust. The characteristics of this approach are (1) careful conceptual analysis of necessary attributes of moral behaviour (2) eclecticism of theory and technique; and (3) concern to relate moral development research to moral educational practice. The Williams' book here reviewed is a fine example of this approach. It makes out the case for the psychological study of moral development, makes the necessary conceptual analysis, and provides a simple account of moral development research and what it means for educational practice. The presentation of the book is as coherent as the state of the literature will allow, and the style is lucid and pleasant.

In a book of this length the Williams obviously had to be extremely selective in their use of sources. Their recommended reading list covers most of the gaps. However, notable omissions occur. For example, there is no mention of the well-documented defects of the retrospective interview. Since one of the Williams' recommended books is Sears, Maccoby and Levin's *Patterns of Child Rearing*, it seems doubly important to warn of the unreliability of the retrospective interview technique which so severely limits the value of that book and much other moral development research.

Criticisms like the above are small points when taken against the very large achievement of writing a simple book on the topic of moral development. At the present stage of understanding of moral development, this book provides in the reviewer's opinion, the best short description of this process, and the implications of this process for the educator, which is currently available.

However, as the Williams point out in the final sentence of their book, "The subject is of such importance and, unfortunately, of such difficulty that it is better to think not in terms of a conclusion but of an introduction."

KENNETH PEASE.

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SENTENCE STRUCTURE AND LEARNING TO READ

By HAZEL FRANCIS

(Department of Psychology, University of Leeds)

SUMMARY. Children's reading strategies, interpretation of sentences and awareness of structure in spoken and written forms are explored to determine how far instruction and reading materials based on linguistic principles of sentence structure might be useful in early reading. It is concluded that the difficulties of attending to a sufficient span of words, and young children's functional, rather than formal, awareness of structure make it unlikely that such instruction would be helpful for children of 5-7 years of age; that when it might be possible to attempt such an approach they can already read and interpret simple sentences; and that the interpretation of sentences rests more on a grasping of semantic content and appropriateness than on a full structural analysis.

INTRODUCTION

FRIES (1962), although himself concerned principally with a phonemic approach, indicated that since about 1870 an emphasis on sentence reading has characterised certain approaches to teaching reading. Underlying these is a notion that the sentence is the unit of expression of thought, and sentence reading is, therefore, more interesting and comprehensible for the child. But whether teaching begins or ends with sentences it may be helpful to know how they are understood by the child.

Lefèvre (1962) and Stern and Gould (1966) claimed that children might be helped to comprehend written sentences by drawing on the knowledge of language structure displayed in their speech. They, therefore, advocated the use of teaching methods designed to exploit the intonation and stress patterns and the syntactic structures of simple sentences, but three important questions were left unanswered. It is not known, first, how soon in early reading a child might be said to be able to span even very short sentences with sufficient accuracy to make use of syntactic features; secondly, how far syntactical information is utilised in interpreting sentences; and thirdly, how far children are aware or might be made aware of the syntax of their speech.

It is often assumed, particularly by linguists, that interpretation is a reversal of the process of construction, and that this is best described by means of a set of rules of syntax which transform the underlying structure on which meaning is based into the surface structure which is read or heard. Such a view is expressed by Katz (1971). Interpretation would then require a syntactic analysis, but it is by no means certain that such a process is, in fact, employed very much in everyday listening and reading. Schlesinger (1968) indicated how adult readers omitted to notice syntactic information except when it was necessary for discrimination between alternative readings, arrived at by a fairly direct processing of content words. Sometimes in conversation one has to attend again to an utterance and consider its structure more fully, for the first quick interpretation is recognised as inappropriate in context.

The research reported in this paper was designed to investigate children's awareness of structure in spoken sentences and their use of sentence structure in learning to read. The tests employed were part of a wider investigation into the language skills of school children. (Francis, 1971).

METHOD

Subjects.

Twenty boys and 30 girls with an age range of six months were tested at six-monthly intervals, the mean age at the first testing being 5 years 9 months, and at the last 7 years 3 months. The sample was deliberately chosen to represent children of good social background and with more than average ability. Social class, as determined by father's occupation, ranged from class I to class III, and vocabulary scores on the Stanford-Binet scale gave a mean of 8.9 and a standard deviation of 2.1 at the final testing. These compared with a standardised mean of 7.4 and a standard deviation of 2.1 for children of the same chronological age (McNemar, 1942).

School.

The approach to teaching reading was broadly based, and teachers tried to meet the individual needs of children. Some rooms, items of furniture and equipment, and personal lockers were clearly labelled; and pictures, posters and items of work decorated the walls, often with accompanying legends. The children worked their way through the McKee reading scheme, reading individually to the teachers. At first something like a 'Look and say' approach predominated, but phonic and phonemic approaches were dovetailed into this as the children responded, both individually and in class teaching, to this more analytic method. Children were, therefore, acquainted with sentence reading quite early but were also helped to learn letter and word structure. They were encouraged to write in parallel with learning to read. Thus, no particular teaching method introduced a bias into the investigations.

Testing.

The author first engaged in pilot study work with other children, so her presence in the school was not strange. The children were tested individually in a small store room adapted for the purpose, and except for a few very shy children, they responded very readily. Details of the test items relevant to this paper are best described with the results, but they were designed to test:

- (a) Ability to read and comprehend simple sentences as measured by a sentence-matching task.
- (b) Awareness of structure in spoken and written sentences as measured by sentence-splitting tasks.

RESULTS

(a) Ability to read and comprehend different simple sentences.

It was desired to explore how children learning to read came to recognise structural patterns in simple written sentences and how such an ability related to their comprehension of sentences. To this end a test was devised based on the fact that the syntax but not the basic reference of a simple active sentence may be changed by turning it into interrogative, negative or passive forms. On the other hand, two syntactically identical sentences may be obtained from transformations of active forms containing different meaning. Thus, the test sentence *Who made the hat?* might be paired with the active form *Ann made the hat* if possible identity of basic meaning is appreciated, or with the transformation *Who made the dress?* if reference is ignored and syntax is matched.

Four such sets of sentences were devised using the who, direct question, negative and passive forms. In each case the test sentence, i.e., the transformation of the active form, was printed on one card while the active form itself

(choice 1) and the semantically different but syntactically identical transformation (choice 2) were printed on a separate card. The children were asked to decide which sentence the test sentence resembled, to say why they made their choice and if possible to read aloud any of the words in the sentences.

All the children enjoyed making choices though a few were not always able to give reasons. The explained choices are summarised in Table 1 where it is seen that sentence structure significantly affected choice. For both forms of interrogative, children at first match predominantly with the same surface structure but on successive occasions there was a significant trend towards matching semantic relations. In the case of the negative more semantic matching was achieved but the trend was less significant, while for the passive very few children achieved a semantic matching and there was no sign of a trend.

TABLE 1

NUMBERS OF REASONED CHOICES IN SENTENCE-MATCHING TASK FROM SAMPLE OF 50 FOR EACH SENTENCE STRUCTURE ON EACH OCCASION.

Choice (see text)	Sentence structure							
	Who		Question		Negative		Passive	
	1	2	1	2	1	2	1	2
Age : 5 yrs. 9m.	6	38	3	42	10	26	6	31
6 yrs. 3m.	19	31	10	40	25	20	8	39
6 yrs. 9m.	18	32	13	34	20	30	6	44
7 yrs. 3m.	24	26	19	31	27	23	5	44
One sample χ^2	12.3		13.0		8.5		NS	
df	3		3		3			
P	.01		.05		.05			

At first so few children were able to read novel sentences that no scores for reading were obtained, but the strategies of sentence matching were explored. On the last three occasions the numbers of different words correctly read were used as reading scores. The maximum was 21. Sentence matching bore some relation to reading ability as shown in Table 2. Since each child made four choices various ratios of choice 1 to choice 2 were possible. There was a clear tendency for better readers to make choice 1 more often. Why this was so can be seen from examining reading strategies and explanations of choices. At first most children matched the sentences by pointing with fingers and painstakingly comparing letter with letter, starting at the beginning of the sentence. At the second testing most were able to compare word with word, and a few, sentence with sentence. The numbers able to compare whole sentences increased at the third and fourth testings. The letter-by-letter strategy led to matching on a basis of first letter or first word differences between sentences and thus to an overwhelming tendency to make surface structure choices. Where semantic matching was achieved it was either by good readers who attended to whole sentence differences or by those whose attention fell on content words. Some negative sentence choices might have been more subject to chance choosing since the first three words gave no basis for choice. At the later testings the left-right approach still led many children to match on a basis of surface structure similarity, but an increasing facility in comparing whole sentences and in recognising frame words led to children paying more attention to content

word differences which challenged them to consider semantic relations, especially in the case of the passive. Relatively few children conveyed reasons expressing some perception of the structural relations between the sentences. When they did, they saw the question and answer relation of interrogatives, the identity of meaning of active and passive and the negative change of meaning. They did not match surface structures by saying, for example, "They are both questions."

TABLE 2

WORD RECOGNITION AND CHOICE IN SENTENCE-MATCHING TASK.

Choices Ratio meaning-based (choice 1) to pattern-based (choice 2)	Average word recognition score (max. 21) at ages :		
	6 yrs. 3m.	6 yrs. 9 m.	7 yrs. 3m.
4 : 0	12.3	20.0	20.8
3 : 1	18.3	18.0	20.5
2 : 2	8.8	16.7	19.7
1 : 3	9.1	11.3	16.3
0 : 4	5.0	11.2	16.9

It was concluded, therefore, that the children were more ready to recognise similar letters or words than whole sentence frames, and that the difficulties of initial reading obscured perception of the major structural features of sentences, particularly where appropriate cues came rather late in the sentence. When children could read more easily they could match sentence frames; and when they focused on content words, whether they read frame words or not, they began to perceive underlying semantic relations more readily and were able to interpret the sentences.

(b) *Awareness of structure in spoken and written sentences.*

The aim of this test was to explore intuitive break-down of sentence into major constituents. The simplest approaches proved to be most readily understood and executed. Nine sentences of different structures and ranging in length from three to seven words were used. For spoken sentences the children were asked to repeat them, but to stop before the end when they felt it easiest to stop. Training examples were given, demonstrating the freedom to stop at any point in the sentence, and when necessary test sentences were repeated for the children. Sometimes they found it impossible to sub-divide a short sentence on this basis, but frequently they were able to do so with apparent confidence and by the fourth testing, when they could read fairly well, they found it easier to sub-divide the spoken than the written forms, especially for very short sentences.

The written sentences were presented individually on cards at the fourth testing, and the children were asked to point immediately to the parts of the sentence they read or looked at first. A training card was used to help convey the instructions and the children were shown how to use a blank card to cover the words not attended to, so confirming their choice of span. The test proved to be straightforward to administer, the children responding readily whatever their ability. After a response they were also asked to try to read the sentence and it was found that children who claimed to span whole sentences could, in fact, read them pretty well.

If children frequently selected the same word position they were asked if they knew they were doing so. In the spoken form although two children showed a preference for the penultimate position and one for the first position they did not seem aware of such strategies, but in the written form of the task 12 children explained that they always attended to the first word while one child claimed always to span two. The two other children showed no consistent position preferences. Since all the children were able to attempt all the spoken sentences the sample size was 50 in all cases, but, because three children were not able to read well enough to attempt all the sentences and consistent reading span strategies were excluded, the sample size was 35 for eight of the sentences and 34 for the ninth. Expected frequencies of equal choice for each word position in each sentence were calculated on the basis of number of words in the sentence and number of attempts. The observed and expected frequencies for word position are shown in Table 3 for spoken forms and in Table 4 for written.

TABLE 3
INTUITIVE SPLITTING OF SPOKEN SENTENCES.

Sentence	Position of word and observed frequency of halt							Expected frequency per word
	1	2	3	4	5	6	7	
1	He 12	feels 38	cold 0					16.6
2	The 2	bed 21	is 26	soft 1				12.5
3	The 2	girl 22	made 13	a 11	doll 2			10
4	We 2	will 16	find 15	some 14	food 3			10
5	Are 4	they 42	ill? 4					16.6
6	She 5	did 11	not 23	break 10	them 1			10
7	My 3	old 12	friend 24	came 9	here 2			10
8	The 2	boy 13	dropped 20	a 7	new 6	jug 2		8.3
9	The 3	men 13	will 2	build 6	a 2	fence 19	today 5	7.1
Halt Totals								
Observed	35	188	127	58	16	21	5	450
Expected	101	101	101	69	55	15	7	449
$\chi^2=156.9$ $df=6$, $P<.001$								

The most obvious difference between the two tasks was the inability to avoid spanning across very short complete written sentences, whereas a forced splitting of spoken sentences was managed more frequently. Otherwise the findings are remarkably similar, although there seemed to be little interaction between the modes. For each sentence only 10 to 15 children chose the same dividing point, a number which holds no significance in view of the shortness of most of the sentences.

The most favoured sentence splitting was after the second or third word, but the actual choice was related to sentence structure, as was seen by comparing frequencies for different parts of speech both within and across position columns. Fewer separations than expected were made after determiners, adjectives, qualifying nouns, auxiliaries and adverbs, while most separations were made after pronouns, nouns or verbs in positions other than first word, and after the negative *not*. A strong preference for the subject noun position was shown, but this was exceeded by a preference for continuing past the subject, both in speech and writing, and halting at either the emphatic *did not* or after the main verb.

TABLE 4
INTUITIVE SPLITTING OF WRITTEN SENTENCES.

Sentence	Position of word and observed frequency of halt							Expected frequency per word
	1	2	3	4	5	6	7	
1	He 5	feels 12	cold 18					11.6
2	The 2	bed 10	is 12	soft 11				8.8
3	The 2	girl 12	made 13	a 1	doll 7			7
4	We 2	will 8	find 13	some 4	food 8			7
5	Are 4	they 14	ill? 17					11.6
6	She 5	did 4	not 19	break 3	them 4			7
7	My 2	old 7	friend 18	came 3	here 5			7
8	The 0	boy 9	dropped 18	a 2	new 1	jug 5		5.8
9	The 1	men 6	will 9	build 6	a 0	fence 11	today 1	4.9
Halt Totals								
Observed	23	82	137	30	25	16	1	314
Expected	71	71	71	47	39	11	5	315
$\chi^2=111.9$ df=6 P<.001								

Lest the group analysis should conceal any evidence of individuals perhaps reaching a point of development at which they made consistent choices after the primary noun phrase or after the verb each child's choice pattern was scanned. For spoken sentences only nine children showed enough consistency to make at least three more choices at either the noun phrase or verb than at any other point, and of these five preferred the noun phrase and four the verb. In the case of written sentences only four children showed such consistency, two preferring the noun phrase and two the verb. In both modes together only two children were so consistent, one preferring the noun and the other the verb. Thus, in both spoken and written forms children's intuitive splitting of sentences showed no clear-cut tendency to honour the primary noun-phrase/verb-phrase distinctions which are basic to much syntactic analysis, but rather indicated that they responded to a complex of cues of which word position in relation to sentence length, noun phrase identification, noun-verb relation, emphasis and negation were all important.

DISCUSSION

To the first question raised in the introduction, it might be said that the results indicate that, in spite of being acquainted with whole sentence reading, children at 5 years 9 months did not for the most part seem able to attend to the whole array and span two or more words when faced with novel short sentences. Instead, they painstakingly tried to approach them letter by letter or word by word from left to right. Not until 7 years 3 months were most able to span two or more words. This finding is similar to McKinnon's (1959) report that children were at first unable to attend to whole words, recognising them primarily by first or last letters. Thus, it would seem unlikely that teaching methods based on assumptions that children might compare or recognise sentence frames would aid reading in the early stages.

The results of the sentence-matching task also indicated that the ability to recognise frame, as distinct from content, words aided neither the recognition of similar sentence structures as wholes nor the interpretation of sentences. Interpretation and recognition of structural relations rested primarily on the ability to read content words. Again this finding is similar to McKinnon's—in this case that children recognised similar sentences by attending to the positions of content words. He found that children did not attend closely to structure words, perseverating with incorrect frames if they recognised content words in a familiar position. Thus, even in early reading children seem to be doing what adults tend to do—read for content, and correct errors on the basis of semantic appropriateness rather than syntactical information (Schlesinger, 1968). In this context it is important to note that McKinnon reported more confident progress in reading when materials were designed not so much to utilise formal structure as to ensure that 'guessing and checking' paid off most of the time.

The possibility of formally utilising children's abilities to structure speech to help them in initial reading would seem to be rather remote in the light of the results of the sentence-splitting task. The children demonstrated an awareness of structure in sentences—a feeling for sub-division—but this did not reflect any simple grammatical rules. Not even the primary noun-phrase plus predicate verb-phrase was honoured. Instead the children demonstrated a sensitivity to a complex of semantic, syntactic and pragmatic features—a sensitivity to functional use of speech rather than to notions of structure. It is worth remembering that one of the fathers of structural linguistics, de Saussure (1916), pointed out that we would never know exactly whether or not the awareness of speakers goes as far as the analyses of the grammarian.

The general conclusion from this paper must be that children of 5 to 7 years of age seem unlikely to be able to respond to teaching methods based on the grammatical structure of sentences, for they do not span sufficient words accurately enough, and their awareness of structure in language is functional rather than formal. This awareness seems to be spontaneously transferred to written sentences when children can span several words, so when it might be claimed that they are ready to respond to notions of grammar they can already read and interpret simple sentences! This is not to argue against sentence reading as part of early experience, however, for few words are interesting or meaningful out of a sentence context; short stories are intrinsically interesting and highly motivating; sentences are necessary for writing and they give a truer picture of the nature and goals of reading.

ACKNOWLEDGMENTS—The author wishes to thank the Chief Education Officer of the City of Leeds, and the headmistress, staff and pupils of the school in which the research was carried out.

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(Manuscript received 16th July, 1971)

THE USE OF DIACRITICAL MARKS IN TEACHING BEGINNERS TO READ

By H. JOHNSON, D. R. JONES, A. C. COLE AND M. B. WALTERS

(*Shropshire School Psychological Service*)

SUMMARY. Parts of books used in a well-known reading scheme were modified by the addition of diacritical marks to indicate the sounds of letters. Children using this diacritical marking medium were compared with matched children using orthodox versions of the books by means of the Burt Word Reading Test and the Schonell Spelling Test (Form B).

It was found that children who used this medium were superior in reading not only in their own medium but also in traditional orthography. Their spelling and the quality and quantity of their free composition was also superior.

INTRODUCTION

RECENT experiments using modified alphabets for the teaching of reading have focused interest on reading media. This contrasts with research in previous decades which concentrated on teaching method; the 'look-and-say' *versus* phonic controversies have received a considerable amount of space in research journals. As early as 1942, Bloomfield (1963) had questioned the initial emphasis on 'meaning' and called for more emphasis on the code used at the introductory stages of reading. However, Bloomfield never considered modifying the alphabet, but emphasised the need to use regular words at the introductory stages. The present experiment seeks to evaluate the effectiveness of one modified code in the classroom teaching of reading.

Modified codes are not new. The history of alphabetic and spelling reforms can be traced back to the seventeenth century when Richard Hodges, a school-master in Southwark, offered a diacritical marking system to the public (Hodges, 1644). This system was the first of many. Leigh's transition alphabet and the Phonotype of A. J. Ellis received extensive experimental trials in the USA during the nineteenth century, and a saving of two years' time in teaching children to read was claimed for these systems.

Perhaps the best known contemporary diacritical marking system is that of Fry who has carried out investigations contrasting the effectiveness of his system (D.M.S.) with i.t.a. and other alphabets (Fry, 1964, 1965). In the first experiment no significant difference was found between the media. The children all learned to read pretty well no matter what medium was used and the difference between classes was much greater than that between media. A second experiment carried out over a few years gave similar results, but seemed to confuse teaching method and reading medium since children using i.t.a. used a different reading scheme from those using D.M.S.

Large scale experiments with Pitman's Initial Teaching Alphabet (i.t.a.) and Jones' Colour Story Reading, both of which are modified codes, suggest that a modified code may be beneficial to children's initial reading (Jones, 1967; Warburton and Southgate, 1969). The code used in the present experiment is the Diacritical Marking Medium devised by Johnson (1961) and fully described by him in the UKRA Conference Issue (Daniels, 1967). On general grounds, Johnson's Diacritical Marking Medium (D.M.M.) seems to have obvious advantages over many other coded scripts. It does not alter traditional spelling,

utilises only one extra colour, can easily be faded out and does not alter letter shapes, so that transfer to orthodox scripts would not be expected to present any great problem. Furthermore, it would be relatively cheap to produce commercially since founts include letters with some diacritical marks and only a little special type should be required (in contrast to the requirements of i.t.a.). Besides, teachers and children can readily write marks in their ordinary books where new or difficult words are experienced.

In this medium, vowels giving their short sounds are printed as usual, while a horizontal line over the vowel indicates that it gives the sound of its name. Silent, modifying and doubled letters are printed in red. The following diacritical marks printed over a vowel indicate further modifications of the medium: A circumflex ('ah'), a small circle ('ooh'), an ellipse ('ai(r)'), the top half of an ellipse ('e(r)') and the bottom half of an ellipse ('aw'). Consonant digraphs are underlined and the long 'i' sound of 'y' is indicated by a horizontal line over the 'y'. Soft 'c' and 'g' have a dot over them. Any words (and there are only a few in the early stages of reading) which cannot be modified by the addition of marks are underlined in red, to be learned by sight as 'special' words.

(Slight modification to the medium might prove more convenient in modifying material already available, for example, the need for a second colour could be obviated by the use of a small cross over silent, modifying and doubled letters. However, the current investigation used the above medium precisely for the reading books and any new material prepared by class teachers).

PREVIOUS RESEARCH

Brimer (1967) completed an experiment designed to evaluate the relative merit of different coded scripts, including D.M.M. The other media were Words in Colour, i.t.a., Coloured Words and traditional orthography (t.o.). As the investigation focused on decoding skills, a programmed technique was used as the reinforcing agent for learning word lists. D.M.M. compared favourably with others in all test results in the experiment, thus indicating that the medium could well have some value at the introductory stages of reading.

THE PRESENT INVESTIGATION

Subjects and Materials.

The aim of the present experiment was to evaluate the effectiveness of D.M.M. in a normal classroom setting, by comparison with t.o. It was possible to enlist the co-operation of three mixed primary schools for a period of two school years, using as subjects selected classes of children who began their formal schooling during this time.

School A has about 240 pupils on roll and is situated in a small mining village. 54 children in this school were involved in the experiment, being taught in the t.o. medium. School C, 350 pupils, is located in a small market town. 83 children in this school used the D.M.M. material. School B, 333 pupils, also serves the needs of a small market town. In this school the new intake of pupils is randomly allocated between two classes, thus forming parallel streams. Some 62 children used t.o. while 59 used D.M.M.

A total of 258 children, therefore, were involved in the experiment from the time they started school to the date of the final testing, which was at the end of a summer term. Consequently, at that date some children had completed only two school terms, while others had been at school for six complete terms

and were of junior school age by the following September. Five children from the t.o. group at school B had even completed eight terms in school following early admission as rising fives. Overall the age range of children at the final test date was from 5 years 4 months to 7 years 9 months.

Already in use in each school was the Ladybird Key Words Reading Scheme published by Wills and Hepworth who kindly consented to the modification of the books needed for children taught by D.M.M. This was effected by the photographing and printing of modified pages of Books 1a to 6a which were then pasted over the existing pages of print for the groups using D.M.M. Gradual fading of cues began in Book 5, and in Book 6 only new words were modified. The 'b' and 'c' series of the reading scheme, although used in all classes, were not modified, but teachers added diacritical marks on specific words causing difficulty to individual children. Furthermore, flash cards, posters and other supporting reading material were modified in the experimental classrooms.

Experimental Procedures

Before the classroom work began, all heads and teachers likely to be concerned in the experiment attended a preliminary meeting for briefing on procedural aspects. Occasional further meetings were held during the experimental period, again with all teachers attending. By involving teachers of both experimental (D.M.M.) and control (t.o.) groups it was hoped to keep to a minimum the 'Hawthorne effect'—a spurious gain in efficacy due to the novelty of a situation and the additional effort often accompanying external interest in that situation. It is probably impossible to completely eliminate the Hawthorne effect, but at least we attempted to share our attention between the groups, so that the teachers of control groups would not feel quite so 'left out' of the experiment. Furthermore, no publicity was given and no special outside visitors saw the experiment in progress apart from the area peripatetic remedial teachers who carried out the testing and gave equal time and attention to both groups.

One variable which could not be controlled was the teacher. Initial suggestions that one teacher should use both media in the same classroom were rejected as being impracticable without creating an artificial experimental atmosphere. (One of the difficulties would have been the necessity of having wall charts and classroom illustrations portrayed in both media in each classroom. Additionally, the teachers' bias towards one of the media might well have clouded the issue.) Teachers were finally allocated randomly to an experimental or control group.

All teachers in the experiment continued the practice of writing the children's original sentences under pictures which they had drawn in their work books so that the children could begin to write by copying, and no formal instructions were given about the use of diacritical marks. Gradually, pupils from both experimental and control groups progressed towards free creative writing.

The 'Look and Say' method of teaching reading previously in use in all classrooms for the initial stages of teaching reading was continued, and no extra phonic instruction was given to the D.M.M. groups.

On intake, a preliminary reading test (Burt Word Reading Test) was given and any child who scored a mark on this was excluded from the final analysis, since he presumably had already begun to read. Progress through the reading scheme was recorded by the teacher and samples of children's original work were

kept. At the end of the experiment, all children were retested with the Burt Word Reading Test. The D.M.M. groups were also tested with a Burt test modified by D.M.M. Additionally, spelling was assessed by means of the Schonell Spelling Test (Form B), and the Raven's Coloured Matrices and Crichton Vocabulary Scale yielded estimates of intelligence. Socio-economic status was gauged by father's occupation using the Registrar-General's five-point classification.

It was then possible to match pairs of children, one taught by t.o., the other by D.M.M., for several factors commonly found to be associated with reading attainment, namely sex, age, IQ, number of terms in school and social class. Just 30 pairs matched on the above factors to the arbitrary criteria set were found, the numbers of children from each of the four groups being approximately equal. Chronological age was matched to within three months, socio-economic group to within one class and number of terms in school exactly matched. Matrices and Crichton scores were each matched to within half a grade, or when combined were within one grade of each other.

RESULTS

Table 1 summarises the comparison of the 30 matched pairs on reading and spelling tests. Related 't' tests were applied to the differences between the scores of the experimental and control groups, indicating statistically significant differences on both reading and spelling tests.

TABLE 1

COMPARISON OF THIRTY MATCHED PAIRS ON READING AND SPELLING TESTS.

	D.M.M. Group mean raw score	t.o. Group mean raw score	Differences between means	't'	P
Burt Word Reading Test (Given in Teaching Script)	21.7	15.1	6.6	3.01	<0.01
Burt Word Reading Test (Given in t.o.)	20.5	15.1	5.4	2.63	<0.02
Schonell Spelling Test (B)	10.2	6.1	4.1	2.54	<0.02

Although the number of subjects was very small, a consideration was made whether there was a trend of increasing superiority of children taught by D.M.M. with time at school. Application of a non-parametric trend test proved statistically non-significant in this respect.

Table 2 gives some indication of the four groups involved in the experiment, including mean scores and standard deviations on the Burt Test administered in the script used in teaching. As mentioned above, in school B the new intake of pupils is randomly allocated into two parallel streams, so that we might reasonably expect matched groups of children from this school. Certainly the physical conditions in the classrooms are almost identical, and the general ideals and standards of the school are the same.

TABLE 2

READING SCORES ON THE BURT TEST ADMINISTERED IN THE TEACHING SCRIPT.

Group	1	2	3	4	Total
School	A	B	C	B	—
Medium	t.o.	t.o.	D.M.M.	D.M.M.	—
Number of children	54	62	83	59	258
Mean number of terms in school ..	4.3	4.7	3.9	4.6	4.3
Mean Score (Burt)	12.67	12.77	6.23	22.69	12.91
Standard Deviation	7.2	12.2	9.4	12.5	12.6

Furthermore, home background and the range of intellectual ability should be roughly equal—an assumption confirmed by the similar standard deviations of groups 2 and 4. Thus, we can reasonably exclude many factors from contributing to the differences between these two groups and compare their scores with an unrelated 't' test. The difference in mean scores in favour of group 4 is 9.9, which is more than four times the standard error of the difference (± 2.27), so the scores of the group taught by D.M.M. are significantly superior statistically to those of the t.o. group ($P < 0.001$).

We have seen with matched pairs and randomly matched groups that children taught by D.M.M. had higher reading scores than those taught by t.o. But how should we view this superiority in relation to the very wide range of attainments always found between schools when we do *not* allow for differences in home background, class size and so on? Analysis of variance on the raw scores summarised in Table 2 indicates that the four groups differed significantly in reading ability ($P < 0.001$). However, the mean score of the two D.M.M. groups (13.07) is not significantly higher than that of the t.o. groups (12.72) so it appears that variations between schools on other factors were sufficient to eliminate any gain due to the use of D.M.M.

DISCUSSION

The present investigation was aimed at evaluating the effectiveness of D.M.M. as an aid in the initial stages of reading in the ordinary infants classroom. Evidence from an artificial learning situation suggested that D.M.M. compared very favourably with t.o. and a number of other media (Brimer, 1967). A popular reading scheme was arbitrarily chosen for modification and by leaving the 'b' series of that scheme unmarked it was hoped to minimise any slight difficulties of transfer to t.o. It was found, in fact, that the 'b' series presented little difficulty to the children who had successfully read the modified 'a' equivalent. Teachers reported that very few diacritical marks had to be added to the 'b' books.

Teachers continued their methods of writing a child's original sentence under his picture for this to be copied. Diacritical marks were spontaneously copied by the children, and at no time did any child ask for a second coloured pencil.

One of the most striking qualitative differences in the later free writing noted by the teachers of all groups was that, whereas the t.o. children tended to write sparsely (if at all) and for the most part used only the words they had met in their reading material, the D.M.M. group wrote earlier and more fluently, and were experimenting with the spelling of new words without soliciting help from the teacher. Further, by using diacritical marks, the children's words were usually phonetically correct and much more readable than equivalent words used by the t.o. group.

Analysis of the Schonell spelling test also showed that the D.M.M. group's mis-spellings were more phonetically correct than those of the t.o. group and that many more words were attempted by the experimental children. These findings, together with the quantitative superiority of the D.M.M. children (see Table 1) leave little doubt that the diacritical marks helped children in their assimilation of phoneme-grapheme relationships.

As far as the teachers of both groups were concerned the fluid, free writing of the D.M.M. children, stemming in part from their superior spelling was, perhaps, the most important outcome of the experiment. That there was such a significant, positive transfer effect to spelling, even on a t.o. spelling test, was encouraging.

The positive transfer effect was also significant in relation to reading. As Table 1 shows, the experimental group were superior in reading, not only in D.M.M. but also in t.o. It would seem safe to conclude, therefore, that the use of D.M.M. facilitates learning to read and that the benefits are neither specific to reading in that medium nor to reading in general. Indeed, it may well prove that the most significant improvements resulting from the use of D.M.M. are in the sphere of writing.

Teachers found no drawbacks in using this medium with any child. It did, of course, involve them in a little extra work in adding marks and changing pencils when writing in children's books or on wall illustrations but this extra effort seemed negligible as they, and indeed the teachers of the control groups, were all anxious to use the medium after the end of the experimental period, despite some reservations they had expressed before the experiment began.

Of course, there are extremely wide variations in reading ability between children for a variety of reasons, and this is why a comparison of matched pairs of children was our prime concern. Table 1 shows clearly the superiority of D.M.M. children on both reading and spelling tests. We argue that this superiority is mainly a result of using D.M.M. It might be argued that better scores are a result simply of better teaching, but teachers were randomly allocated to an experimental or control group, and more than one teacher was used with each group in each school over the two-year span, so the chances of using only the better teachers for D.M.M. groups were diminished. Attempts were made to reduce the Hawthorne effect, but perhaps such attempts can never be perfect. However, we *are* certain that all teachers of control groups were very interested in the experiment and gave of their best during the experiment.

Fortunately, two groups of children were used at school B, randomly matched as groups with the school factor additionally held constant. The difference between control and experimental groups in this school is even more marked than when considering matched pairs (but from a variety of schools), thus confirming the considerable variance between schools shown in Table 2. It is, perhaps, unfortunate that events in school C reduced what might have

been an overall significant difference between the means of the total number of experimental and control children. Fluctuations in intake meant large class size in relation to the other three groups of children. This led further to a shorter overall stay in the infants' department since no rising fives could be admitted due to overcrowding—hence the lower number of terms in school for group 3 and an added difficulty in matching pairs for both age and time in school. Finally, at this school there were frequent changes of staff during the experiment—a factor particularly detrimental to this D.M.M. group since each new teacher had to become familiar with the medium as well as with her new pupils.

Thus, three unexpected and unwelcome factors interacted to lower the scores of one of our experimental groups and to increase the variability between schools. Comparison of these 83 children with previous or subsequent pupils at the school was invalidated by the difference in class size (extra accommodation is now in use) and differences in staff stability. Internal comparison within the school during the experiment proved impossible once the experiment was under way. So the unexpected events so common in field studies once again confused the issue and made global comparisons between D.M.M. and t.o. children less valid for our purposes. Nevertheless, children from group 3 were included in our sample of 30 matched pairs, so that the observed differences in Table 1 may well be rather conservative estimates of the pure beneficial effect of D.M.M.

CONCLUSIONS

The experiment confirms Brimer's findings that the use of D.M.M. facilitates word recognition in orthodox script and furthermore shows D.M.M. to be a feasible medium for normal classroom use with existing reading schemes. Although it would be necessary for teachers to familiarise themselves with the medium, no extra tuition is necessary for the children who in this experiment have shown that incidental learning is more than sufficient to produce superior results in reading and spelling.

ACKNOWLEDGMENTS—The writers wish to express their appreciation and thanks to Wills and Hepworth, Ltd., for allowing the use and modification of their books, also to the heads and teachers without whose willing help the investigation would not have been possible. We are also indebted to those pupils from two local secondary schools who helped in the preparation of materials.

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(Manuscript received 15th September, 1971)

SOCIAL CLASS DIFFERENCES IN LANGUAGE PREDICTABILITY

By MILLICENT E. POOLE

*(Centre for the Study of Urban Education, La Trobe University, Bundoora,
Victoria, Australia)*

SUMMARY. Two cloze tests were constructed from speech interviews encoded by 80 university students of middle-class and working-class origin. In an experimental situation, 55 tertiary subjects were asked to 'fill in' the missing cloze deletions of passages presented aurally. It was predicted, within the Bernstein elaborated—restricted coding model, that working-class passages would be easier to decode because of their higher lexical and structural predictability. The analysis was based on a verbatim cloze completion criterion and an information theory approach. Results on the former criterion revealed significant social class message differences (in terms of high predictability for working-class speech and low predictability for middle-class speech); whereas the latter showed non-significant trends in the predicted direction.

INTRODUCTION

THE basic postulates of Bernstein (1961) in relation to verbal coding complexity and elaborateness have been a major research focus for the past decade. A number of validity studies (Olim, Hess and Shipman, 1967; Lawton, 1968; Coulthard, 1969; Williams and Naremore, 1969) have underpinned Bernstein's theory of elaborated and restricted coding orientations in terms of social class differences in syntactic and structural complexity, discrimination in the choice of qualifiers and modifiers, and in planned logical linguistic sequencing. There are dimensions of the elaborated-restricted code model, however, which have never been adequately explored. Lawton (1968, p. 98) and Coulthard (1969, p. 41) for example, have pointed to the absence of clarity in Bernstein's work in relation to the predictability dimension of the elaborated-restricted coding continuum. Bernstein defined his codes in terms of the probability of predicting which syntactic and lexical elements would be used, across a representative range of speech, to organise meaning. In elaborated coding, the probability of predicting linguistic elements is reduced because of the relatively extensive source of alternatives available to the encoder. In restricted coding, on the other hand, the probability of prediction is increased because of the limited number of linguistic alternatives. In this coding context, does predictability mean the relative frequency percentage score for class elements or syntactic combinations or does it mean, as information theory implies, the ability to replace correctly parts which have been deleted from a message?

There seems a need, then, not only for theoretical clarification but also for testing the viability of the predictability notion. By using some objective criteria of language predictability it may be possible to determine whether the thesis of social class difference in language predictability is a meaningful dimension of the Bernstein model. An approach used by information theorists and psycholinguists—cloze procedure—was, therefore, selected as an objective measure of language predictability in a socio-cultural context.

In proposing a rationale for cloze procedure, Taylor (1953, 1954) made two suggestions. On the one hand he linked linguistic decoding with perceptual decoding as being an instance of the Gestalt principle of closure, while on the

other he saw it as part of Shannon and Weaver's (1949) generalised communication model. This second viewpoint is the more powerful one and leads to a definition of cloze procedure as :

"A method of intercepting a message from a 'transmitter' (writer or speaker), mutilating its language patterns by deleting parts, and so administering it to 'receivers' (readers or listeners) that their attempts to make the patterns whole again potentially yield a considerable number of cloze units." (Taylor, 1953, p. 416.)

In this way, cloze procedure can be used as a psychological tool for gauging the degree of correspondence between the encoding habits of transmitters and the decoding habits of receivers (Taylor, 1954). Generalised communication models usually comprise source, message and receiver systems and Osgood (1959) has indicated that source systems vary in terms of encoding habits, values, attitudes ; message systems in terms of lexical items, syntactical structures, voice qualifiers ; and receiver systems differ in decoding habits, and comprehension ability. In terms of a generalised language communication model, then, it seems feasible to apply cloze procedure to test differences in middle-class and working-class 'source systems' which Bernstein postulated differ in encoding habits and communication facility, and 'message systems' which differ in lexicon, syntax and qualification. Osgood (1960), for example, showed how cloze procedure can index language predictability or stereotypy ; the more stereotyped the message as a whole (in terms of lexical, grammatical, and syntactical choice) the better the subjects will be able to replace items deleted from the message. On this basis, items in working-class message systems should be easier to replace because a restricted code is characterised by high lexical and structural predictability.

Cloze procedure has been used in a number of psychotherapeutic studies of language predictability : to differentiate the speech of aphasics (Fillenbaum and Jones, 1962) and schizophrenics (Salzinger and Salzinger, 1967) from that of normal speech ; to determine whether psychiatrists can predict their patients' speech (Feldstein and Jaffe, 1963) ; and to gauge the effect of drug ingestion on language predictability (Honigfeld, 1963). A number of non-clinical applications of cloze procedure has also appeared, for example, Fillenbaum, Jones and Rapoport (1963), used cloze procedure to study both the grammatical and lexical predictability of speech from running speech transcripts ; Taylor (1956) compared the predictability and listenability of words deleted from two radio newscrips. In an interesting study reported by Peisach (1965), cloze procedure was used to evaluate the extent to which information was successfully communicated from teachers to pupils of various social backgrounds, and the degree of effective communication among children from different social class backgrounds. Similar research on negro children's speech was undertaken by Williams and Wood (1970).

Robinson (1965) purported to use cloze procedure to investigate differences in the verbal behaviour of working-class and middle-class boys. Cloze tests were constructed from the letters (formally and informally written) and the oral utterances of middle-class and working-class boys. Two of Bernstein's propositions were investigated : the extent to which middle and working-class subjects used the same lexicon and the difference in predictability of working- and middle-class utterances. The results showed that middle-class boys used a wider range of words, and that working-class boys displayed more conformity in their responses (stereotypy). Unfortunately, however, Robinson used single sentences for his cloze deletions and his experiment, although valuable, resembles a

sentence or gap completion test rather than a continuous oral cloze test. Taylor (1953) was quite specific in stipulating that cloze procedure is not a sentence completion test, since cloze tests deal with contextually interrelated series of blanks, not isolated ones. Robinson, apparently, was not familiar with this distinction. Consequently, his 'cloze' tests do not really sample language patterns in complete message systems.

Cheek and Amarel (1967), using college subjects for a study concerned with cloze performance generally and with the prediction of alcoholic and schizophrenic speech specifically, followed two broad lines of investigation: socio-economic background and verbal performance. The results indicated that the verbal performance variables appeared to relate more to cloze procedure than to the socio-economic variables. These results suggest that in terms of predicting message systems, the textual profile of a message may be more critical than the social background characteristics of the decoders. Characteristics cited by Cheek and Amarel as influencing predictability included: frequency of usage of words contained in the message; the distribution of grammatical forms; the degree of syntactic organisation; the transitional probability of the occurrence of words in sequence; and a combination of these factors.

The predictability studies cited so far have used a cloze score to index message difficulty. It is possible, by using an information theory approach, to obtain a mathematical value for the redundancy or uncertainty of individual cloze items or of entire cloze passages. Information theory indicates that the success with which a set of receivers of a message can fill in its missing parts is a measure of the redundancy of the message (Aborn and Rubenstein, 1952; Attneave, 1959; Pollack, 1963; Edwards, 1964; Anderson, 1969). If the context surrounding a blank enables a cloze result of 100 per cent to be achieved there is no uncertainty about the correct word and the redundancy is maximum. If, at the other extreme, the cloze score is zero, absolute uncertainty (entropy) exists, because everyone has selected a different alternative, i.e., there is no redundancy. In this connection, redundancy and uncertainty can be viewed as complementary measures, so that it is possible for a cloze deletion to yield a score of zero per cent correct and yet have maximum redundancy, if all decoders or receivers supply the same 'incorrect' word. A critical difference therefore emerges: cloze scores use the actual message of the source as a criterion, whereas redundancy indices relate to the uncertainties of receivers (Taylor, 1956; Osgood, 1959). It seems, then, that cloze procedure can provide two separate measures: one of subjects' ability to restore passages on the verbatim criterion (predictability) and one of the redundancy characteristics of passages based on communality of responses (predictability viewed as high redundancy or low uncertainty). The question, therefore, emerges as to whether the notions of predictability and redundancy can be applied, within a socio-linguistic framework, to reveal differences between middle-class and working-class message systems, in accord with the Bernstein thesis generally, and specifically to assist in the clarification of this theoretical dimension.

In summary, Bernstein's (1965) socio-linguistic theory postulates, in relation to specific properties of codes, that the structural and lexical elements are highly predictable for restricted codes, much less so for elaborated codes. In terms, then, of a communication model rationale for cloze and socio-linguistic theory, the following hypothesis can be formulated:

Hypothesis 1: Oral middle-class messages are less predictable or stereotyped than oral working-class messages (i.e., subjects replace more cloze deletions on working-class messages).

In terms of information theory, higher uncertainty could be expected for middle-class messages because they are less stereotyped in style, suggesting the following hypothesis :

Hypothesis 2 : The relative uncertainty of oral middle-class messages is higher than that of working-class messages (i.e., subjects tend to agree on the word they select to fill working-class messages, whether this word is the same as the correct response or not).

The experimental procedures used to test these hypotheses are presented below.

METHOD

Middle-class and working-class message systems.

To obtain a comprehensive sampling of middle-class and working-class speech, the verbatim transcripts of oral interviews conducted with 80 first-year university students (40 working-class in origin, 40 middle-class) chosen at random from 484 university entrants stratified on the basis of social class, in accord with Bernstein's two criteria—father's occupation and level of education—were used as source material for the development of two cloze tests : middle-class oral, working-class oral. To make the tests as representative as possible of the message systems of each social class group, samples of speech from 40 students were selected at random and arranged in logical sequence without alteration to the original speech samples. Additional words were sometimes included for continuity of sequence or ideational transition but such words were not included in the cloze deletions.* Once the criterion of obtaining representative samples of middle-class and working-class message systems had been met, a number of other criteria guided the preparation of the four cloze tests.

A structural-lexical breakdown of the passages was required. Working on the basis that half of each test was to contain lexical deletions and the other half structural deletions, all words were classified before the passages were mutilated. After applying an every fifth-word deletion procedure, every mutilation was examined to see if it fell in the specified word class. If not, it was re-inserted and the closest word to the fifth with the correct class was deleted, i.e., a modified cloze deletion system (Greene, 1964) was used. As a modification of Taylor's (1954) formula of keeping the first and last 10 words of a passage intact, the first paragraph was left unmutated to ease subjects into decoding the oral tests. Further unmutated paragraphs were interspersed by the experimenter through the tests to combat listening fatigue. Since research on cloze procedure has indicated that the greater the number of responses contained within a cloze test, the greater the reliability, 100 deletions—50 lexical, 50 structural—were made in each test, to obtain reliable total cloze scores and valid structural and lexical sub-scores (Taylor, 1954).

Subjects.

Subjects used in the experiment were first-year university students who had enrolled in a Basic Study Skills course, 13 female, 42 male, a total of 55 students. Because it is difficult to determine how closely the characteristics of students enrolled in a Basic Study Skills course mirror the characteristics of the total student intake in any one year, a comparison was made on a number of cognitive variables (e.g., intelligence, critical thinking, syntax, vocabulary) to see if any significant differences emerged which might prejudice the findings.

* Copies of the cloze tests and full details of the interview questions on which the tests were based can be found in Poole, (1970).

In terms of the cognitive abilities examined, no significant differences emerged.

Test Administration.

(a) *Recording the oral cloze tests:* Prior to administration, the oral cloze tests, with all appropriate instructions, were recorded on to magnetic tape by the experimenter. All sections were recorded at 9.5 cm. per second. The cloze tape was divided into five sections: (1) an introductory section which included an outline of the experiment and procedural information; (2) practice items; (3) the first oral cloze test; (4) a refresher set of instructions; and (5) the second oral cloze test. The various words chosen for deletion were marked on a typed transcript and, as the test was being recorded, the position where a subject was required to substitute a word was indicated by a 1,000 sine-wave c.p.s. tone 70 db. above the threshold of hearing. The tone was of three seconds' duration. Use of a tone was considered the most effective means of alerting students to cloze mutilations (Williams, 1962; Gregory-Panopolous, 1966)—an unfilled pause may have been confused with the natural pausation occurring in speech and the insertion of the word 'blank' at each cloze deletion point was rejected in the interests of listening efficiency. The passages were read in their entirety and, as each word selected for the cloze deletion was reached, the tone was sounded. At the end of each sentence, an additional pause of 5 to 10 seconds occurred to provide subjects with ample opportunities for recording their responses.

(b) *Aids used in cloze test administration.* Cloze test answer sheets were designed to assist students in the organisation of their responses to the test. In addition cloze test number cards were used as a 'silent' aid for sentence orientation and were considered a less intrusive method of indicating sentence numbers to students than orally interjecting or writing the number on a blackboard. The numbers 0 to 35 were printed in 4 in. red letters on heavy white paper, 8 in. by 13 in. Cards were 'flipped' in sequence as each new sentence occurred, so that the students could check placement of responses on their answer sheets with the number being held up by the experimenter.

(c) *Test administration.* Subjects were divided into small groups (8 to 15 students) and were given the tests in the same small seminar room on subsequent mornings. A small group testing arrangement was particularly necessary for the experiment so that each subject could hear the tape plainly and without distortion, and so that the cloze number cards were clearly visible to all subjects. The administration of the tests between groups differed only in that, to minimise the practice effect, the order in which the oral passages were given was changed in sequence for each group, i.e., an attempt was made to randomise the effect of order of test administration (middle-class/working-class passages or working-class/middle-class passages). Subjects were given a brief rest period between the first and second tests. Considerable care was taken to minimise what Lindquist (1953) called Type G errors by ensuring comparable seating, lighting, and ventilation standards; by using standardised sets of instructions for each test; and by eliciting student co-operation in creating an appropriate testing situation.

Scoring Procedures.

The cloze tests were scored on the verbatim score response criterion (i.e. exact replacement of a deleted word was necessary to score one mark) by computer, thereby ensuring marker reliability. Three scores were calculated for each subject:

(1) A total cloze score (i.e., the total number of verbatim replacements of

deleted words for each passage).

- (2) A lexical score (i.e., a separate score of lexical deletion replacements only).
- (3) A structural score (i.e., the number of structural deletions correctly replaced).

In addition, using a logarithmic formula from information theory (Taylor, 1954) a redundancy and uncertainty measure for each cloze deletion and for each cloze passage was calculated.

$$\text{Redundancy} = \frac{H_0 - H_1}{H_0} \quad \begin{array}{l} H_0 = \text{uncertainty before the cloze test is} \\ \text{administered} \end{array}$$

H_1 = final uncertainty after the cloze test has been completed.

$$= \frac{\sum_{j=1}^N \sum_{i=1}^N n_{ij} \log_2 n_{ij}}{N \log_2 N} \quad \begin{array}{l} n_{ij} = \text{frequency of the } i\text{th response in item } j \\ \text{and } n_j \text{ is the number of distinct responses} \\ \text{to item } j. \end{array}$$

N = total of equiprobable alternatives.

i.e., if the total reduction in uncertainty is expressed as a proportion of the initial (maximum) uncertainty, an estimate of the redundancy of the passage over which the cloze test was constructed is obtained (Anderson, 1969).

Statistical Analysis.

To compare the performance of subjects on decoding middle-class and working-class messages, Sandler's A-statistic for correlated samples was chosen (Runyon and Haber, 1967). In this way, each subject was able to serve as his own control. To test the significance of the differences between the uncertainty measures for working-class deletions and middle-class deletions, a simple randomised analysis of variance design was used (Winer, 1962). Both statistical tests were used to analyse total cloze scores, and lexical and structural sub-scores separately.

RESULTS

Test reliabilities were calculated for cloze tests using Coefficient Alpha. This coefficient is generally considered to provide a good estimate of reliability because it takes account of content sampling which may be a major source of measurement error. The reliability for the middle-class test was .66 and for the working-class test .73. Means and standard deviations for each test, together with Sandler A statistical comparisons, are presented in Table 1.

TABLE 1
MEANS, STANDARD DEVIATIONS AND TESTS OF DIFFERENCES FOR ORAL CLOZE SCORES ON
MIDDLE-CLASS AND WORKING-CLASS PASSAGES.

Cloze Score	Middle-Class		Working-Class		Sandler's A for passage difference ($df=54$)	P
	Mean	SD	Mean	SD		
Lexical	16.38	4.52	23.45	4.70	0.026	< .001
Structural ..	23.94	4.45	26.60	5.35	0.084	< .001
Total	40.32	6.53	50.05	8.57	0.026	< .001

The data presented in Table 1 enables Hypothesis 1 to be accepted. In each instance subjects were able to replace significantly more cloze selections from the working-class messages.

To test Hypothesis 2, the redundancies and relative uncertainty of responses for every word in each passage, and for each passage as a whole were estimated. An example of computer output from the program used to calculate the redundancies and uncertainties is shown in Table 2.

TABLE 2

RESPONSES TO ITEMS 50 TO 56: WORKING-CLASS ORAL PASSAGE.

BUT	AND	BY	TO	FOR	THAT	OF
however 4	and 25	by 33	for 3	for 55	that 38	of 49
(blank) 10	the 1	hand 1	to 50		(blank) 2	(blank) 1
them 1	(blank) 14	for 6	with 1		mostly 1	type 1
and 7	by 6	(blank) 7	do 1		cases 1	for 2
again 1	who 5	more 1			always 2	pre 1
but 17	luckily 1	and 1			pretty 1	is 1
luckily 1	for 1	with 1			was 1	
then 5	as 1	amongst 1			its 1	
with 1	had 1	hard 2			it 4	
when 2		whom 1			definite 1	
room 1		mostly 1			is 1	
who 2					for 1	
between 1					still 1	
only 1						
while 1						
uncertainty .64541	.54960	.42141	.09757	.00000	.34139	.12848
no. correct 17	25	33	50	55	38	49
% incorrect .69090	.54545	.40000	.09090	.00000	.30909	.10909
Relative uncertainty for passage = .31198			Redundancy for passage = .68801			
Passage per cent incorrect = .30649			Subjects = 55			

TABLE 3

MEANS, STANDARD DEVIATIONS AND F-TESTS OF UNCERTAINTY OF DELETIONS FOR ORAL MIDDLE-CLASS AND WORKING-CLASS PASSAGES.

Cloze Test	Middle-Class		Working-Class		F-Tests*		F
	Mean	SD	Mean	SD	Mean Square		
					Between	Within	
Lexical deletions	·488	·223	·419	·220	·118	·050	2·359 (NS)
Structural deletions ..	·437	·236	·409	·213	·019	·051	·386 (NS)
Total deletions	·462	·231	·414	·217	·116	·050	2·288 (NS)

* df = 1,98 for lexical and structural; df = 1,198 for total.

The original word deleted from the passage is indicated at the top of each response frequency distribution. Below this distribution, the relative uncertainty for the item, the number of correct responses per item, and the percentage of incorrect responses are listed. At the bottom of each table summary statistics for the seven items are given. These sub-totals can be progressively summated to obtain the relative uncertainty of a complete passage. The means and standard deviations for the complete passages and for the lexical and structural sub-sections are reported in Table 3, together with a summary of the analyses of variance computations.

Hypothesis 2 was not confirmed although the F values closely approximated the .05 level of significance on the total passages and on the lexical sub-section. From Table 3 it is evident that the trend in passage uncertainty is in the predicted direction, the middle-class oral passages ranking above the working-class passages on relative uncertainty on all three dimensions.

DISCUSSION

In distinguishing the characteristics of message systems, in terms of lexical and structural predictability, it was found that middle-class messages were generally more difficult to predict. Conversely, working-class message systems were more predictable and stereotyped. Although not directly comparable, these results find some support from the findings of Peisach (1965) and Williams and Wood (1970) which indicated that both high and low class subjects could fill in cloze deletions equally well on lower class speech samples but not on middle-class speech samples, where middle-class students were able to obtain higher scores.

The differences between group means were greater on the lexical deletions than on the structural suggesting that the choice points occurring in middle-class lexicon involve a more extensive search for the appropriate word among a more complex verbal network from which alternatives are available. The problem may be more than one of availability of lexicon, however. It may be that the social role relationship involved in an interviewer-interviewee situation with its inherent social pressures might increase the level of anxiety of the working-class encoder, thereby inducing verbal stereotyping. When single structural deletions were used, the results indicated that, for the present subjects, working-class structural elements were more predictable than those of middle-class messages. In terms, then, of two criteria—lexical and structural predictability—as measured by verbatim cloze responses, working-class messages satisfy restricted code criteria and suggest qualitatively different planning orientations of working-class from middle-class message encoders who, because of lower lexical and structural predictability in their verbal planning, transmit a message system which approximates an elaborated code.

The results on the uncertainty measures for working-class and middle-class systems, while not statistically significant, indicated a trend in the predicted direction. There was slightly higher uncertainty about which structural and lexical words to use in replacing cloze deletions in middle-class message systems. There are a number of possible reasons why the results did not reach the required level of significance. It could be that, while cloze procedure indexes vocabulary usage it does not, because of single unit deletions, permit an adequate estimation of syntactic predictability. Single function words may be difficult to replace, but a measure for testing the predictability of larger syntactic units may be needed before valid pronouncements about the syntactic redundancy of elaborated and restricted codes can be made. In

addition, there is the problem of communality of response for cloze deletions, as against verbatim responses. If message decoders use the same word to replace, for example, a most unusual lexical choice by a middle-class encoder, there is no uncertainty and redundancy is maximal, in terms of information theory (Taylor, 1954). However, this redundancy is different from the stereotyped phraseology and repetitive lexical and structural usage entailed in Bernstein's (1965) socio-linguistic thesis of restricted code predictability and elaborated code high uncertainty, i.e., low structural and lexical predictability. In this connection, Robinson (1965) found that working-class subjects exhibited greater overall conformity in response to cloze tests, and suggested that middle-class boys used a stereotype in filling cloze deletions, making their choice of words fit their idea of working-class language. If this is so, perhaps most students are inclined to fill in cloze deletions with a 'convergent' response, i.e., the word they think fits the pattern and not the word they themselves would use or they imagine someone else might use to specify unique intent. Consequently, a tendency towards conformity or convergent responses would depress the level of linguistic uncertainty without really indexing the unique characteristics (in terms of Bernstein's low lexical and structural predictability) of the total message system.

In reconciling the results from both parts of the study, then, it is necessary to note that while subjects experienced greater difficulty in replacing the exact words used by middle-class subjects, they were, nevertheless, able to agree on an alternative which fitted the sense of the passage, consequently reducing the relative uncertainty in decoding the middle-class message systems.

Where does this lead in terms of theoretical amplification? A little distance it would seem. Bernstein's dimension of predictability is given some empirical support by this study, but the issue is still a very open one. Obviously, there is need for further research. It may be desirable to use a 'situational' approach, defined in terms of the informality or formality of the role relationships involved, to detect predictability and flexibility in verbal coding over a variety of contexts. Overriding this there would seem to be a need for the development of more sophisticated techniques for examining language samples, in terms of predictability, on more than a single word basis.

ACKNOWLEDGMENTS—I wish to thank Mr. W. B. Olphert, Director of the Educational Research Unit, University of New England, Armidale, for funding the study and Dr. J. Anderson, Senior Lecturer in Education, also of the University of New England, for allowing me to use his computer programmes for cloze analysis and for advice on cloze test construction.

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PERSONALITY AND ACADEMIC ATTAINMENT*

By N. J. ENTWISTLE

(*Department of Educational Research, University of Lancaster*)

SUMMARY. Research using the scales developed by Eysenck and Cattell is reviewed at school level and in higher education. The results suggest an age-effect in which academic success at primary school is linked to stable extraversion, while success at university is associated with introversion. This simple pattern is, however, complicated by a variety of interactions which indicate that the relationships may differ with intellectual level, with type of institution and with the subject being studied. There is also a suggestion that the style of teaching may affect the relationships between personality and attainment. Finally, evidence on the stability of scores on the JEPI is used to question the direction of causality normally assumed in the interactions.

INTRODUCTION

ONE of the recurrent themes to be found in educational research involves the attempt to unravel the complex determinants of academic attainment. Early work concentrated on intelligence as the explanatory variable and this is still the single most effective predictor of school achievement. Subsequently, a wide variety of research reports has drawn attention to the importance of social factors and early experiences of the child in the home. Environment affects both the development of intelligence and the level of achievement. But any attempt to understand the complete causal chain associated with school attainment must include the effect of personality on the child's work in the school.

Personality has been defined by Allport (1963) as "the dynamic organisation within the individual of those psychophysical systems that determine his characteristic behaviour and thought" (page 28). If this definition is accepted it appears inevitable that personality will be an important determinant of classroom behaviour and ultimate scholastic success. The measurement of personality is, however, far from simple and the initial lack of success in isolating personality correlates of school attainment to a large extent can be attributed to this difficulty. The advent of pencil and paper group tests which have been carefully developed and validated has stimulated renewed interest in this research area. As a result there is now a sufficiently large literature for certain trends to emerge. Most of the British studies have used the personality inventories developed by either Eysenck or Cattell. This review thus concentrates on these factorial approaches to the measurement of personality.

MEASUREMENT OF PERSONALITY

Eysenck and Cattell have used different methods of identifying the factors which can be used to describe human personality. The resulting structures appear dissimilar at first sight. Papers by Burt (1965) and Adcock (1965) and a recent book (Eysenck and Eysenck, 1969a) have compared and contrasted the two approaches. Basically Eysenck had strong theoretical grounds for hypothesising two important, yet distinct, dimensions underlying human behaviour. Factor analysis designed to produce unrelated factors, allowed

* An extended version of this article will appear in *Educational Research in Britain*, 3, edited by H. J. BUTCHER and H. B. PONT, to be published by University of London Press, late 1972.

Eysenck to choose items for his inventory which measured the traits of extraversion and neuroticism (emotional instability). Among children at least, the correlation between these two dimensions is generally found to be significantly negative and not zero. However, these scales are still being developed and new versions are expected shortly.

An understanding of the terms extraversion and neuroticism, as used by Eysenck, demands a study of the items included in the various inventories (Maudsley or Eysenck in both junior and adult versions). Neuroticism is characterised by unnecessary worrying, by feelings of restlessness, by moodiness and by general nervousness. The stable person shows behaviour which is generally controlled; he tends to be reliable, even-tempered and calm. The typical extravert is "sociable, likes parties, has many friends, needs to have people to talk to, and does not like studying by himself. He craves excitement, takes chances, often sticks his neck out, acts on the spur of the moment, and is generally an impulsive individual . . . The typical introvert, on the other hand, is a quiet retiring sort of person, introspective, fond of books rather than people; he is reserved and distant except with intimate friends. He tends to plan ahead, 'looks before he leaps,' and distrusts the impulse of the moment" (Eysenck, 1965, pages 59-60). Scores on these two dimensions are expected to be normally distributed with the majority of people being neither extraverted nor introverted, neurotic nor stable. For certain analyses, however, it is useful to identify individuals with above or below average scores on each trait and to describe four personality 'types'—stable extraverts, stable introverts, unstable extraverts and unstable introverts.

Cattell (1965) prefers to use an alternative method of factor analysis which produces inter-related factors. Out of a vast range of items, he has isolated up to 17 primary source traits which are given the alphabetic notation shown later in Table 1. Because the factors are inter-related it is possible to simplify Cattell's structure by repeated factor analyses which extract higher-order factors. Warburton (1968a) provided a lucid summary of the pattern of higher-order factors. The five second-order factors are reduced by successive analyses down to two fourth-order factors, as shown below:

<i>Second-order</i>	<i>Third-order</i>	<i>Fourth-order</i>
Stability	Adaptation	Integration
Conservatism		
Extraversion	Thrust	
Toughmindedness		
Conscientiousness or Morality	Morality	Morality

It is interesting to note that the two most important second-order factors are extraversion and stability, which are similar to Eysenck's major dimensions. Another two factors carry labels identical to what Eysenck sees as social attitudes (Eysenck, 1951). Eysenck has also moved away from the simple two-factor structure both by adding a psychoticism dimension (Eysenck and Eysenck, 1969b) and by subdividing extraversion into sociability and impulsivity (Eysenck and Eysenck, 1963). There is thus a considerable amount of overlap in the two descriptions of personality. In terms of the actual inventories the Cattell questionnaires (CPQ, HSPQ and 16PF for children, high-school pupils and adults) have the disadvantage of being lengthy and yet having short, rather unreliable, sub-scales. They also have American phraseology in places. Nevertheless, the possibility of being able to investigate up to 17 dimensions, rather than two, has an obvious appeal.

Investigations into the relationship between personality and academic attainment have used both types of inventory. Taken overall the findings appear somewhat contradictory, but a pattern emerges if the studies are examined separately at each of the main educational stages.

RESEARCH AT SCHOOL LEVEL

Two large-scale investigations of the relationships between personality and attainment among school children have been reported. Eysenck and Cookson (1969) were able to analyse the test scores of some 4,000 pupils in their final primary year from schools throughout Staffordshire. Entwistle and Cunningham (1968) used data from an almost complete age-group of 3,000 13-year-olds in Aberdeen secondary schools. Even with two such large samples there is still no close agreement between the results. An examination of the differences does, however, draw attention to some of the complexities involved in this research area.

In the introduction to their article Eysenck and Cookson provide an excellent review of the literature, including studies using both types of inventory. They conclude, from examination of studies by Jones (1960), Morrison *et al.* (1965), Ridding (1967), Rushton (1966) and Savage (1966), that the extravert tends to be better at schoolwork in late primary and early secondary school. Similarly, the work of Butcher *et al.* (1963), Callard and Goodfellow (1962), Hallworth (1961) and Lunzer (1960) is used to hypothesise a link between neuroticism and poor performance at this age level.

In their own study Eysenck and Cookson confirmed that it is likely to be the stable extraverts, as a group, who are more successful among primary school pupils. Their zonal analyses did provide some indications on non-linearity, but the patterns of mean scores by personality type did not follow the 'Yerkes-Dodson' law: there was no tendency for both high and low scores on neuroticism to be related to poor academic results. Other studies on school children (Brown, 1970; Banks, 1964) have found this inverted-U relationship, as did Lynn and Gordon (1961) with students, but Entwistle and Cunningham (1968) demonstrated linearity of regression among their findings.

This last study with 13-year-olds in Aberdeen secondary schools again found that stability was related to academic success. On the other hand, the extraversion dimension produced an unexpected sex difference. Extraverted girls but introverted boys tended to be more successful. The difference was small, but does indicate the importance of analysing results separately by sex.

The main difference between the Aberdeen results and those of Eysenck and Cookson lies in the higher correlation between extraversion and attainment in the latter study. Eysenck and Cookson attribute this effect to the age difference in the samples and point out that there is a tendency for introversion to be associated with academic success among older children and students. This suggestion also links neatly with some of the findings based on the Cattell inventories.

The multi-dimensional approach used by Cattell makes it difficult to present a coherent picture of the results of studies using this definition of personality. The use of many more traits might, nevertheless, make the possibility of high

multiple correlations more likely. Cattell, Sealy and Sweney (1966) maintain that up to 25 per cent of the variance in school attainment may be attributable to the effects of personality. This suggestion is, however, speculative as it was based on correlations corrected for the effects of unreliability in the measures. Even after these corrections the value of correlations between the primary traits and attainment remained below .3. Nevertheless, some agreement is to be found between this study and that reported by Cattell and Butcher (1968). The primary traits of conscientiousness (G+), submissiveness (E-), friendliness (A+) and dependability (Q₃) are related to achievement in both samples. Cattell and Butcher report a regression equation, which, by including the dimension of intelligence (B), leads to multiple correlation of .7 with academic success. The constants in the equation indicate the weightings given to each trait.

$$\begin{aligned} \text{Achievement} = & +.15A + .50B + .10C - .10D - .15E + .10F + .25G + .10H \\ & - .10I + .15J - .100 + .20Q_2 + .20Q_3 - .10Q_4 \end{aligned}$$

It is too soon, however, to put much trust in such a prediction equation. The variations in relationship between samples will lead to considerable fluctuation in the weightings. In fact, individual studies taken separately do not provide a coherent picture in terms of the primary source traits. The unreliability of the sub-scales, the doubt as to the meaning underlying the individual traits (Eysenck 1972a) and the small scale of many of the studies, all combine to make this confusion inevitable. Fortunately, a lucid summary of research using the Cattell tests is already in existence (Warburton, 1968b) and has been particularly valuable in preparing this paper.

Warburton, who was closely associated with the work of Cattell for many years, chose 29 of the most satisfactory studies to demonstrate the existence of a pattern of relationships in terms of the second-order factors. Table 1 presents a condensation of Warburton's summaries, based on the 25 studies which used Cattell inventories. The articles from which these results were derived are shown among the references, marked with asterisks.

Warburton drew attention to the same age trend noted by Eysenck. Stable extraversion is related to success in the primary school, changing over to introversion and possibly to emotional instability by age 18. From the pattern shown in Table 1 it appears that the change-over both from stability to neuroticism and from extraversion to introversion in fact occurs late in the secondary school. The abrupt reversal of relationships after age 14, particularly that between introversion and attainment, is quite remarkable. All 13 relationships obtained with younger children are negative, with extraverts being more successful; out of 18 with older pupils and students only two are in this direction. Perhaps the change-over from junior to senior versions of the inventories affects the results, but it is difficult to explain such a clear-cut change in the direction of the relationship in this way. The fact that this reversal co-incides with the school leaving age may give an indication as to its cause. Between 15 and 18 the majority of young people move into employment and out of the reach of educational research workers. The remaining captives are highly selected on both intelligence and social class. It may be that the different relationships between personality and attainment are a characteristic of this restricted population found in sixth forms and in colleges and universities.

TABLE 1

SUMMARY OF RESULTS FROM STUDIES USING CATTELL'S INVENTORIES: DIRECTION OF CORRELATION COEFFICIENTS WITH SCHOLASTIC ATTAINMENT (ADAPTED FROM WARBURTON, 1968b, TABLE 3).

Second-order Factor	Primary Source Trait	Age Group							
		Under 12		12-14		15-17		Over 17	
		+	-	+	-	+	-	+	-
Anxiety/ Neuroticism	Instability (C-)	0	3	0	1	3	0	3	2
	Tenseness (Q ₄ +)	0	1	0	1	1	0	5	1
	Insecurity (O+)	0	0	0	2	1	0	1	1
	Bad-temperedness (D+) ..	0	1	0	2	2	0	0	0
	Unreliability (Q ₃ -) ..	0	1	0	5	0	2	0	2
	Suspiciousness (L+) ..	0	0	0	0	0	0	2	2
	Total	0	6	0	11	7	2	11	8
Introversion (1)	Aloofness (A-)	0	0	0	6	3	0	0	1
	Desurgency (F-)	0	3	0	0	8	0	3	1
	Shyness (H-)	0	2	0	2	3	0	1	0
	Total	0	5	0	8	14	0	4	2
Introversion (2)	Submissiveness (E-) ..	0	1	7	0	4	0	1	2
	Independence (Q ₂ +) ..	1	0	3	0	3	0	1	0
	Total	1	1	10	0	7	0	2	2
Tendermindedness ..	Tendermindedness (I+) ..	0	0	1	0	2	0	3	0
	Unaffectedness (N-) ..	0	0	0	0	0	0	1	0
	Total	0	0	1	0	2	0	4	0
Radicalism	Bohemianism (M+) ...	0	0	0	0	0	0	4	0
	Radicalism (Q ₁ +)	0	0	0	0	0	0	1	0
	Total	0	0	0	0	0	0	5	0
Morality	Conscientiousness (G+) ..	2	0	6	0	4	1	2	3

The signs following the letters in parentheses indicate the direction of scoring on the trait. For example, shyness is inferred from low scores (negative sign) on trait 'H'.

RESEARCH AT COLLEGE AND UNIVERSITY LEVEL

Warburton's summary provides convincing evidence of the superiority of the introvert in higher education. Savage (1962) in Australia and Lavin (1967), who reviewed the American literature, both reached the same conclusion. The precise relationship of stability-instability to good performance is, however, much less clear. Furneaux (1962) suggested the importance of instability; Kelvin, Lucas and Ojha (1965) showed that the first-class honours graduates and those students who failed both showed high neuroticism scores on the whole. But other studies by Savage (1962) and by Lynn and Gordon (1961) have found a different relationship in which students who had high or low instability scores did worse than those who had moderate scores. The American literature also

produces contradictory evidence, in spite of the use of large samples in some studies. Lavin (1967) concludes that, on balance, the stable student is likely to be the more successful. Warburton and Eysenck both reached the opposite conclusion in Britain, but results from recent studies have been more equivocal. Kline and Gale (1971) found little evidence of a significant relationship between either neuroticism or introversion and marks in a first-year psychology examination. Wankowski (1968) has suggested that it is stable introverts who do best at university. Smithers and Batcock (1970) find similar results for social scientists in a technological university, but not for health scientists. Variations in relationships among students taking different academic disciplines, are also reported in a recent study by Wilson (1971). Extraversion was significantly related to failure for all students in the arts faculty. Stability was linked with failure, but only for arts women. This study also shows that factors indicating success are not necessarily the converse of those related to failure. Equations predicting success may include rather different variables than those used in identifying students who are at risk.

Not only are different relationships to be expected in contrasting subject areas, but there may also be differences among samples drawn from the three distinct sectors of higher education. Most of the evidence comes from universities. To date no consistent pattern of results seems to be emerging from studies either in technical colleges (Staveley, 1967; Venables, 1967; Cowell and Entwistle, 1971) or in colleges of education (Halliwell, 1963; Cortis, 1966). Clearly it is important to have results in which the same tests have been given to comparable samples drawn from all three sectors. A study at Lancaster is following-up a group of some 2,600 students from 20 different institutions. A preliminary analysis on about half of this sample (Entwistle *et al.*, 1971b) has already shown interesting differences both between areas of study and, to a lesser extent, between universities and colleges. For example, neurotic introverts apparently make good engineers, as Furneaux found, but stable introverts do better in the pure sciences. Neurotic introverts are also good at languages, but stable introverts make better historians. Among social science students the correlations between both personality dimensions and attainment were near zero, which fits in with the findings of Kline and Gale.

Taken overall the greatest consistency in results occurs with the extraversion trait. On the whole introverts do tend to be more successful. Correlations ranged from $-.26$ to $-.03$ in different subject areas at university, from $-.21$ to $-.07$ in comparable groups at college of education and from $-.10$ to $.08$ at polytechnics. The neuroticism trait was much less consistent, equivalent ranges being $-.24$ to $.28$, $-.27$ to $-.07$ and $-.42$ to $-.05$. Neuroticism is positively correlated with academic performance only in certain sub-groups of the student population, at least on the evidence of this particular study.

There thus appears to be some doubt about the generality of the earlier suggestion that unstable students tend to be successful. The findings are conflicting and, while the possibility of subject-area differences may help to resolve some of the confusion, there are likely to be alternative explanations for this situation. For example, Eysenck (1972b) suggests that it is necessary to distinguish between trait anxiety, which is usually measured, and state anxiety, which may be more relevant in determining examination success. Eysenck goes on to attack the use of the simple Hullian equation relating performance to drive and habit. It is important to identify habit-systems which are important in academic behaviour. Under this heading might be included study methods, attitudes to studying, and the dimension recently described by Hudson (1968)

as "syllabus-bound/syllabus-free." Academic motivation is perhaps in an intermediate position between drive and habit. Eysenck suggests that "theoretically at least, introverted habit systems would seem likely to predispose students to engage in good study habits, so that high anxiety drive in introverts would lead to even more strenuous study." It is not known at present whether good study habits combined with introversion and neuroticism are particularly likely to lead to academic success, but empirical results do indicate that good study habits, as defined in two separate inventories, are related to stable introversion (Entwistle and Wilson, 1970; Entwistle and Entwistle, 1970; Cowell and Entwistle, 1971; Entwistle *et al.*, 1971a). Also academic motivation is linked to stability (Entwistle, *et al.*, 1971b) and the syllabus-bound dimension to introversion (John, 1972).

The link between stability (*low* drive) and either motivation or study methods is not ruled out in Eysenck's elaboration of the elementary theory of drive and performance. However, it is possible to put forward alternative formulations of the effect of neuroticism on academic study. It may be precisely the combination of high motivation with emotional stability which summarises the characteristics of the student with 'high drive'—at least in the everyday use of this term. Descriptions of stability imply low reactivity to stimuli. Perhaps in this particular context we need to extend the neuroticism dimension further to include strong reaction in a non-neurotic direction. Then drive might be linked with high reactivity in either direction and both extremes might lead to success for differing groups of students. This would represent a parallel to the distinction met elsewhere in the literature between 'achievement motivation' and 'fear of failure' (Birney, Burdick and Teevan, 1969). The Eysenckian formulation, which modifies the direction of anxiety (drive) according to previous habits, may well co-incide with the concepts of 'facilitating' and 'debilitating' anxiety as described by Alpert and Haber (1960). It certainly appears that the use of elaborate theoretical models may lead to more sophisticated investigations into the relationship between personality and attainment; there is also room for improvement in the research designs used in such studies.

PROBLEMS AND GROWTH-POINTS

There is a variety of factors which may explain the contradictions between findings which abound in the literature reviewed in this paper. Before attempting a final summary of the outcomes of this research, various aspects of research design which may have affected results will be briefly discussed.

Methods of analysis.

The commonest forms of analysis applied to data on personality and attainment have been correlation techniques and zonal analysis. Both approaches lead to difficulties. The major problem involved in zonal analysis is the definition of the various personality 'types.' Many studies have created four types simply by dichotomising the scores on each dimension at the median value. To equalise the size of groups it is better to plot the two-dimensional scatter diagram of extraversion against neuroticism. But both these methods are specific to a particular sample and prevent direct comparisons being made between studies. Agreement to define personality types in terms of the norms presented in the test manuals for each age-level or sub-group of the adult population would be a useful move, at least where the norms have been derived from samples of adequate size. As much of the research is done on rather small

groups, it might be necessary to make the extreme groups fairly close to the overall mean. Personality types might then be created by taking scores of $\pm 0.5 \sigma$ either side of the means reported in the manuals, or, where necessary, dichotomising at this mean value. Studies having larger samples might be able to report additional analyses of more extreme groups (perhaps $\pm 0.75 \sigma$). Nevertheless, the advantage of comparability produced by a standard way of creating 'types' is off-set by the artificiality and rigidity of using arbitrary cut-off points which do not reflect, even in an intuitive way, variations in relationships existing in the data. Clearly other approaches and other methods of analysis should also be attempted.

Most of the research reported in this paper has involved the use of various correlational techniques. While these methods of analysis have distinct advantages in terms of ease of communication, they do have definite weaknesses. It is possible to dismiss a non-linear relationship in reporting an insignificant product-moment coefficient and also to ignore the possibility of important interactions between variables. Correlations average out the relationships over the whole sample, ignoring possible differences between sub-groups. It is certainly useful to apply correlational techniques to sub-groups, where these are known in advance. But, in view of possibilities such as the one discussed in the previous section, that anxiety may affect the performance of different students in opposite directions, alternative methods of analysis might be more appropriate.

Whereas correlational techniques compare similarities between *tests* over the whole sample, the method of cluster analysis and classification procedures compare similarities between *people* over the complete battery of tests. They provide indications of groups of people who have the same patterns of scores. It would thus be possible, in principle, to identify two separate groups of students both with high neuroticism scores, one showing high and the other low attainment scores. Recent developments in computers have made cluster analysis a more attractive possibility and some promising analyses of data have already been reported (Entwistle and Brennan, 1971). One classification procedure in particular (automatic interaction detection) allows sub-groups to be produced on the basis of the various inter-actions existing in the data, rather than being created by arbitrary or subjective decisions. This method of analysis seeks to maximise the prediction of a criterion variable by forming sub-groups in terms of a small number of 'explanatory' variables. It thus appears to be a potentially fruitful approach to the problem of isolating interactions between personality and other variables in relation to academic performance. Early results from an analysis of data from university students (Brennan and Entwistle, 1972) have thrown up the possibility that introversion is related more closely to attainment in a sub-group of science students with moderate A-level results who see themselves as being 'hard-working,' than in other sub-groups.

Measurement of attainment.

The results reported in earlier sections were all based on scores from either Eysenck or Cattell personality inventories, but academic attainment was measured in a variety of ways. Some of the differences in findings may be attributable to these variations.

In some studies attainment is measured by objective tests of English and mathematics; in others verbal reasoning tests are used. A few studies have reported analyses based on performance in programmed learning tasks, in which the time allowed for these tasks may be an important consideration in itself

(Seddon, 1972). External or internal examination marks are found frequently in the literature. While all these measures may well show fairly high inter-correlations, they still represent alternative definitions of attainment, which could have rather different personality correlates. 'Academic attainment' surely implies that pupils or students have been assessed in terms of their performance on the courses they have actually taken in school or college. Thus, tests of verbal reasoning, though correlated with academic attainment, are not direct measures of success in school. Similarly objective tests of English and mathematics provide only two components of school attainment. Even in primary schools many other mental skills are important—for example, there is an increasing emphasis on individual expression in music, art and language. It seems improbable that a single set of personality correlates will adequately describe success in such different forms of intellectual activity.

There is some evidence that different personality characteristics are linked to success with contrasting definitions of attainment (W. Rudd, 1970; Bennett and Entwistle, 1972). Bennett, in a piece of ongoing research, is using two contrasting measures of attainment in primary, middle and secondary schools. Early results from the primary stage are based on a conventional measure of school attainment (teachers' rank-orders scaled on a verbal reasoning test) and on impression marking of imaginative stories. As anticipated, rather different relationships between personality and attainment are emerging from the two types of measure. Bennett has confirmed the superiority of stable extraverts in conventional attainment at this age-level, but a sex difference was found when results from the imaginative stories were analysed. High scores were given to boys who were stable extraverts, but to girls who were unstable extraverts.

Similar differences might also be expected in secondary schools. Again standardised tests, used on their own, may not correspond at all closely to the teacher's view of school attainment. With a large number of subjects included in the curriculum perhaps the most valid measure of overall achievement will be a sum or an average of marks taken from the whole range of subjects. These marks will generally have to be scaled against a standardised test of scholastic aptitude to allow comparisons between classes and between schools. The assumption here is that the consensus of opinion among teachers provides the best indication of the rank-order of achievement within a class, while an objective test is a more accurate way of deciding the standard of that class compared with others. During the later stages of secondary school sums (or averages) of grades at O- or A-level in the GCE make satisfactory measures of academic success without any scaling procedure.

Finally, in higher education the growing tendency to include both course work and examination marks in the overall assessment of students suggests further division in the definition of attainment. Differences in the correlates of success from discipline to discipline have already been demonstrated. There is a distinct possibility that course work and examination may favour different personality types. Again research on this possibility is already being undertaken (E. Rudd, 1970).

Additional complications.

Throughout this review it has been assumed that the measurements of extraversion and neuroticism using Eysenck's scales are internally consistent and that the scores are stable. The manual (Eysenck, 1965) reports split-half

reliabilities varying from age to age around .8 and test/re-test reliabilities after one month around .7. Only recently have follow-up studies over a longer period given further evidence on the degree of stability to be expected. Sharples (1971) with primary school children has found correlations on the JEPI over one year to be down to about .55. Bennett (1972) has summarised evidence from a number of sources. One analysis produced test/re-test coefficients of .38(E) and .51(N) after one year (ages 10-11), while other results compared scores on the JEPI and the EPI. When the tests were taken on the same occasion by 15-year-olds, correlations of .82 (N) and .87(E) were obtained. In spite of this high level of overlap between the senior and junior versions, the correlation between equivalent scales from age 13 to 15 was found to be down to .33. If these values are substantiated, they would suggest a degree of instability previously unsuspected in the literature. Shifts in relationships between personality and attainment with age might then be explained as much in terms of changes in personality within contrasting academic environments as in changes in attainment.

Bennett (1972) also pointed out some apparent weaknesses in the extraversion scale of the JEPI. Response rates of over 80 per cent are usually viewed with concern in the development of Likert-type tests. In three separate age groups Bennett found the same 12 extraversion items with response rates above this level, and these items produce a lack of 'ceiling' on this scale. Looking at the items it appears that the 'translation' of adult situations from the EPI into the JEPI may have led to anomalies. Most of the 12 items refer to social extraversion and three refer specifically to behaviour at parties. Such social occasions presumably have a different meaning for adults than for children; a translation of situations does not necessarily make the items equally useful for different populations. It seems possible that impulsivity items, rather than social extraversion items, may be distinguishing between extraverts and introverts in the JEPI. This situation might again affect the observed relationships between personality and attainment.

Another complication relates to the possibility of various intervening variables which may affect the size or the direction of the relationship between the two main dimensions under consideration. It is already clear that sex and age have been acting in this way. Further analysis of the data obtained from the follow-up of Aberdeen secondary pupils by Entwistle and Welsh (1969) suggested that there might also be different relationships among bright children compared with those found for pupils of below average ability. Dividing their sample into top and bottom thirds in terms of ability level, they found that introversion was linked to high achievement for bright boys, whereas extraversion was the more favourable trait in the low ability group. The results for girls were similar, but less marked.

Some support for this finding can be obtained by taking two comparable studies with secondary modern children on the one hand (Fraser, 1967) and with grammar school pupils (Duckworth and Entwistle, 1972) on the other. Both studies used the JEPI with children aged 12-13 years and obtained separate correlations with attainment in English and Mathematics. Fraser's secondary modern sample showed positive correlations between extraversion and both measures of school attainment. The grammar school sample produced correlations which were both negative. It does seem possible, although the evidence is still tenuous, that introversion is related to success for the brightest children in secondary school even as early as the second year. Among the low

ability group extraversion is still associated with high achievement at age 14 (Entwistle and Welsh, 1969).

There are other intervening variables which may affect the relationships between personality and attainment. A number of studies have observed differing relationships among urban children and rural children (Cattell and Butcher, 1968 ; Entwistle, 1967), but these may be a reflection of differences in classroom organisation, in average class size or in methods of teaching. The range of approaches in primary schools, between formal and informal methods, suggests that different personality types would be successful in contrasting educational climates. These possibilities are being investigated at present (Sharples, 1971 ; Bennett and Entwistle, 1972 ; Eysenck, 1972).

Finally, it seems probable that there will be an interaction between the teacher's personality and the performance of children of differing personality types. There are formidable obstacles to research of this kind, but it may be crucial to overcome them. It may be only in this way that the observed relationships between personality and attainment will be fully explained.

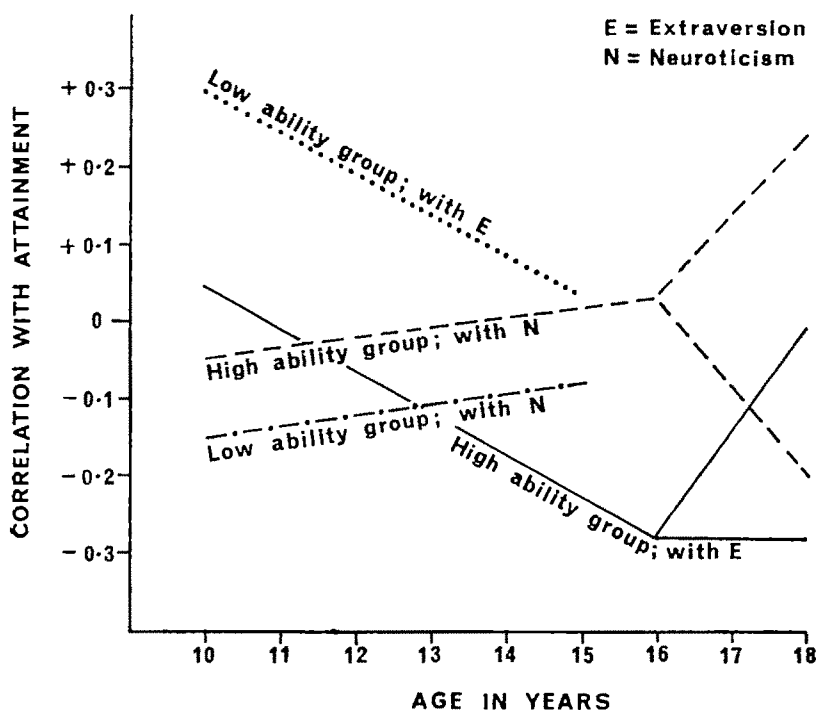
CONCLUSION

The last few sections have outlined a personal view of problems and growth-points in research into personality and attainment. Recent work at Lancaster has figured rather prominently in this subjective perspective, as the author is less familiar with ongoing research elsewhere. There are almost certainly important developments which have been undervalued or ignored altogether. Similarly the map drawn in describing the literature may represent the operation of selective perception. Despite this, two major conclusions may be drawn with some confidence. First, it is dangerous to assume wide generality in statements about the relationships between personality and academic attainment. Age, ability, sex, geographical area, classroom organisation, class size, teaching methods and teacher personality may all affect these relationships to some extent. Nevertheless, the second conclusion does indicate the existence of some overall pattern in this confused research area : there is now considerable agreement as to the existence of an age effect. Many apparent contradictions in the literature are resolved by the recognition that stable extraverts tend to be successful in primary schools, while introverts, and possibly even neurotic introverts, predominate among outstanding students. It is not clear, however, to what extent personality, rather than attainment, is changing over this period.

Figure 1 represents an intuitive graph, based partly on research evidence, which indicates how the pattern of observed relationships may change with the age and ability level of the pupils forming the sample. Extraversion and stability remain advantageous longer for children of below-average ability. Introversion is related to success among bright children soon after entering secondary school. It may be possible to simplify even further the relationships shown in Figure 1. If the correlation were to be plotted against *mental age* rather than chronological age, a single line might adequately describe each of the relationships. If a bright child of age 10 can be assumed to be equivalent intellectually to a child of low ability aged about 15, the four discrete lines would almost merge into two. However, such neatness is unlikely to coincide with reality in this particular research area.

FIGURE 1

INDICATION OF VARIATIONS IN CORRELATIONS BETWEEN PERSONALITY (E AND N) AND CONVENTIONAL MEASURES OF ACADEMIC ATTAINMENT, BY AGE AND ABILITY.



Variations after age 16 dependent on area of specialisation.

Finally, it may be salutary to look for practical, rather than theoretical, importance in the research findings. It still requires considerable faith and imagination to see where these results may lead. The lack of generality in relationships and the probable link between teaching methods and personality correlates of success both reinforce the growing realisation of the importance of variety in the presentation of material to be learned. Even at the same intellectual level no one teaching method or way of organising learning experiences will be ideal for all pupils or for all students. Ultimately, it may be possible to allow the 'consumers' to choose the method of instruction, at least in the later stages of education. Formal, systematic presentation may still be preferred by some; unstructured freedom may suit others. An understanding of personality differences may help to anticipate such preferences. Research into the relationships between personality and academic attainment, with an emphasis on changes with age, may provide guidance as to the appropriate provision of alternative methods of presentation at different educational stages.

ACKNOWLEDGMENTS—This review represents the initial stage of a study being supported by a grant from the Social Science Research Council. Earlier work was sponsored by the Scottish Council for Research in Education.

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(Manuscript received 10th September, 1971)

THE URBAN OR RURAL BACKGROUND OF FIRST-YEAR UNIVERSITY STUDENTS IN RELATION TO THEIR ACADEMIC PERFORMANCE*

BY R. R. DALE AND P. M. MILLER

(*University College of Swansea*)

SUMMARY. The association of the urban/rural variable with university academic performance was assessed by a matched pair procedure. Variables matched were sex, co-educational/single-sex school, examining board (W.J.E.C. only), Arts/Science faculties, and (for A-level) number of subjects taken, best subject, average grade and number of attempts. Social class was mostly matched but partly balanced. Student pairs were selected from a three-year entry to Welsh University Colleges, with first-year results unknown.

A comparison of urban (over 16,000 population) *versus* rural, produced little difference between the matched samples, except that the urban Arts students from single-sex schools did better than their rural counterparts. Limiting urban to cities over 100,000 while still opposing this to rural (under 16,000) increased the differences, so that in four separate matched samples namely, city co-educated Arts *versus* rural co-educated Arts, city co-educated Science *versus* rural co-educated Science, and similarly for single-sex schools, the city students had the better first-year performance, statistically highly significant for the combined samples. Students from intermediate sized towns in all groups performed less well than those from both city and rural schools, producing a curvilinear relationship between performance and the urban/rural variable.

INTRODUCTION

IN the search to understand the vagaries in the performance of university students many variables have been investigated, but the urban/rural one has received little attention, though the transition from school to university life and work would seem to be a greater change for the rural-based student than for his city-bred counterpart. Forster's (1959) finding that students from Belfast schools did better at university than those from schools outside Belfast points this way, though he was unable to disentangle the urban/rural factor from the clear difference associated with 'direct' entrance to the university and entrance 'delayed' by one year, and from the effect of the poor results of a 'combined' course taken mainly by non-Belfast students. There may also be a difference in the intellectual capability of the Belfast compared with other entrants, especially as some Belfast schools are of higher prestige and attract the better candidates from outside their local area. In Australia, where admittedly the urban/rural dichotomy is more extreme, students from rural high schools are generally recognised as a vulnerable group (Miller, 1970). For example, Schonell *et al.* (1962) found the university performance of students in the Brisbane metropolitan area somewhat superior overall to that of country students though admittedly both the average IQ and entrance attainment level of the latter were slightly lower.

The criterion used to separate urban and rural here was the size of the population of the place in which the student's school was situated. As the students' home addresses were not known, the location of the school attended was used as the nearest approximation.

*Part of a project assisted by the SSRC.

PROCEDURE

To assess the extent of association between the urban or rural nature of students' backgrounds and their academic performance in first-year university examinations matched samples were constructed from several thousand students at university colleges in Wales who studied at least one of eight specified subjects (French, History, Geography, Applied Mathematics, Pure Mathematics, Physics, Chemistry and Botany). Pairs of students, opposed on type of background, were matched exactly on sex, average grades in the A-level examination, best subject and number of attempts; almost all sat three subjects or more in the examination of the Welsh Joint Education Committee but those who sat only two were paired together. Most students were matched on social class, but some imprecise matchings were rectified by 'balancing' opposing samples. The remaining social class differences were small and not consistent in direction. Two variables were eliminated by separation: co-educated/single-sex educated, and Arts/Science Faculty. (Economics and Geography students were included in Arts). Four sets of matched samples resulted in the first instance, namely (1) Co-educated Arts students from urban schools (population over 16,000) *versus* co-educated Arts students from rural schools (less than 16,000), (2) co-educated Science students from urban schools *versus* those from rural schools, (3) and (4) similarly for those from single-sex schools. No student's academic performance at the university was known during the matching. Opposing halves of the samples were then compared, using as criterion the difference between the mean scores of each pair member in the three subjects taken in university first-year examinations, expressed as a stanine grade. In other words, the academic performance of each student was assessed by his rank in relation to *all* other students in his class in a particular subject. The *smaller* the stanine grade the better the performance. The number of student pairs in each matched sample was the maximum that could be extracted from the various parent populations; the number of pairs, therefore, changes for each comparison.

RESULTS

(1) *Urban (over 16,000) versus rural.*

The analysis started with an urban (over 16,000) *versus* rural dichotomy. In this first division there was almost no difference between the average stanine grades of the urban and rural groups within three of the matched samples; but within the fourth a distinct difference in stanine grade was found, Arts students from urban single-sex schools being appreciably better than Arts students from rural single-sex schools.

The difference was in the anticipated direction, on the hypothesis that students from rural areas would find the transition from school to university more severe than would students from urban areas, perhaps especially in Arts.

As the expected difference had not occurred within the other three matched samples, the data were re-examined and it was seen that distortion might be occurring, partly because the chosen cut-off point ignored the differences between the city conurbations and the industrial towns, and partly because the criterion used to determine whether a student was urban or rural was not the position of his home but that of his school. Since many students from rural areas attended schools in towns of more than 16,000 inhabitants and were being classed as urban, any real difference due to the urban or rural background of the home was being obscured.

A new dividing line was, therefore, used comparing (a) students from schools in Swansea, Cardiff and Newport (all with over 100,000 population) with those from schools in places of less than 16,000 population (producing a truly urban sample on the city side as few of the school pupils are from outside the city boundaries) ; and (b) students from schools in places of 16,000 to 100,000 (in practice 60,000) population with those from schools in places of less than 16,000 population.

For both these comparisons the relevant matched pairs used for the first analysis were retained. The results are given in Sections 2 and 3.

(2) *City schools compared with rural* (towns under 16,000).

The results of this second division are in Table 1. City schools are in the urban conurbations of Swansea, Cardiff and Newport (Mon.).

TABLE 1

PERFORMANCE OF CITY AND RURAL STUDENTS IN FIRST YEAR UNIVERSITY EXAMINATIONS.

Students from :	No. of pairs	City schools	Rural schools	Mean advantage to city schools	t
		Average grade (Range 1—9)	Average grade (Range 1—9)		
Single-sex schools (Science) . .	16	4.83	5.77	+0.94	1.92
Single-sex schools (Arts) . . .	31	4.71	5.18	+0.47	1.73
Co-educational schools (Science)	13	4.72	5.31	+0.59	1.00
Co-educational schools (Arts)	17	4.65	5.32	+0.68	1.45
Overall	77	4.72	5.35	+0.63	3.11*

* $P < 0.01$.

Table 1 shows that 154 students were matched as 77 pairs, divided into the four relevant samples. In each of these four samples the city students had distinctly the better results, the difference verging on conventional statistical significance at the .05 level for the Science students from single-sex schools and near this level for the Arts students from single-sex schools. When all four samples were merged the difference in favour of students from the city schools was 0.63, statistically significant beyond the .01 level. When the Arts students from single-sex schools were excluded (as the difference was first noted in a closely similar matched group), the difference remained statistically highly significant ($t=2.58$). Hence, when the extreme cases were taken—city students *versus* students from schools situated in towns of less than 16,000 inhabitants, the city students reached better university grades at the end of the first year.

(3) *Schools in intermediate-sized towns compared with those in communities of less than 16,000.*

The logical progression at first sight would be for students from schools in large conurbations to do best, for those from schools in intermediate sized towns to do less well and for those from schools in more rural areas to do worst. Here,

however, we have the matched rural based students doing better than those from the intermediate sized towns, that is, from towns of between 16,000 and 60,000 inhabitants. The difference is statistically significant ($P < .05$) for Science students from single-sex schools, and also overall. The difference is in the same direction for the three other matched samples.

TABLE 2

PERFORMANCE OF RURAL STUDENTS COMPARED WITH THOSE FROM INTERMEDIATE SIZED TOWNS.

Students from :	No. of pairs	Schools in Intermediate towns	Rural schools	Mean advantage to rural schools	t
		Average (Range 1-9)	Average (Range 1-9)		
Single-sex schools (Science) ..	10	6.93	4.92	2.02	3.06*
Single-sex schools (Arts)	24	4.99	4.80	0.19	<1
Co-educational schools (Science)	30	5.08	4.82	0.26	<1
Co-educational schools (Arts)	45	5.28	5.02	0.26	<1
Overall†	109	5.31	4.91	0.41	2.20*

* $P < 0.05$.

† The size of this difference clearly depends on the proportion of pairs from each sample and the size of the difference within each sample.

(4) *Schools in small rural communities (<10,000), versus those in larger rural communities.*

The last analysis is the apposition of students from schools in small rural communities (<10,000) with those from schools in the larger rural communities (10,000 to 16,000).

TABLE 3

SMALL *versus* LARGE RURAL COMMUNITIES.

Students from :	No. of Pairs	Schools in large rural areas	Schools in small rural areas	Mean advantage to small rural	t
		Average grade (Range 1-9)	Average grade (Range 1-9)		
Single-sex schools (Science) ..	5	5.40	4.13	1.27	1.79
Single-sex schools (Arts)	8	5.46	5.29	0.17	<1
Co-educational schools (Science)	26	4.87	4.80	0.07	<1
Co-educational schools (Arts)	30	5.36	4.94	0.42	1.01
Overall	69	5.19	4.87	0.32	1.28

In Table 3 we see that the direction of the tendency for the students from the rural based schools to do better at university than those from medium sized towns is continued, inasmuch as the students from schools in the small rural areas do rather better than those from schools in larger rural centres. The difference, though small and depending for single-sex schools on fewer pairs than we would wish, is consistent for all four comparisons, though not statistically significant. It is of some interest that the difference (and probability level) is again greatest for Science students from single-sex schools.

DISCUSSION

In this large sample of university students in Wales there appears to be a curvilinear relationship between the urban/rural variable and academic performance at the end of the first year. If this relationship holds good for other areas it might account for the paucity of findings on this variable, as researchers may have been looking for a straight line correlation. Here we note that in Scottish studies (SCRE, 1953, 1958, 1963), admittedly with younger age groups, scores in intelligence, arithmetic and English were found to be highest in small towns and cities, with large towns next and 'other areas' last. Though there are some differences between this pattern and that of the present findings, the city averages are high in both cases and those of the large towns low.

The technique used ensures that the finding is not due to the contrasting distributions of co-educational and single-sex schools, to unequal proportions of the sexes coming from these areas, differences between Arts and Science students, and differences in level of academic performance on entry; this last variable including points such as the number of attempts at the A-level examination and taking three or more subjects. Nor can the findings be due to variations between examination boards. Though also the students were at four of the federated colleges of the University of Wales, this variable had previously been examined and appeared to have little effect. Furthermore, restricting the samples to pairs with both members from the same institution increased the differences found. Nor could we discern any systematic effect associated with small remaining social class imbalances in the samples. Moreover, research has usually failed to establish an association between social class and academic performance at the provincial universities except in unusual circumstances. (Smithers and Batcock, 1969).

To what factors, then, might the urban/rural differences be related? The results give support to the view that students from the conurbation schools probably find the transition from school easier than rural students; city students are at home in the environment, with its distractions and its opportunities. The rural student, in spite of modern transport, is unaccustomed to the social pace, the time-consuming cultural opportunities and the lures of city life. He may never have entered a large library, let alone have used one. In Wales even the language spoken may be different in the rural home compared with university, though all would have a good command of English. Other students, accustomed to the small intimate rural community may feel lost and alone in the city rat race (cf Schonell *et al.*, 1962). Handicaps at school may include long hours of travel, restricted subject choice and no choice of subject teacher. Again the standard of teaching may be different. Some of these arguments are also applicable to the student from a medium-sized town.

The causes of the slower progress of students from the intermediate sized towns, when compared with both the city students and those from rural areas seem more complex. The rural based child may well be slower in pace, but having won the same entrance qualifications as his 'pair' from the intermediate sized towns, the industry and motivation that he has needed to overcome his handicaps and to gain entrance stand him in good stead at the university. The student from the medium sized town has not needed to strive quite as hard to overcome handicaps and at the same time has not had the compensating advantage of complete familiarity with city life. He may, therefore, have less determination to succeed than his rural counterpart, and though his town life may resemble city life more than the rural life does, this may not be sufficient to redress the balance. It is also possible that the neighbourhood background in the intermediate-sized towns is not as steady as that of the rural hamlet.

The slight superiority in progress, in first-year studies at the university, of students from schools in the smallest rural communities compared with those from schools in larger rural towns may be due to chance, to the theory set out in the last paragraph, or to some factor not yet detected.

The possibility that the results in general were affected by the proportion of students from the various areas who lived at home was checked by withdrawing from the samples any student pair of whom at least one could possibly have lived at home. (The direct information was not available.) The findings remained the same: there was even a consistent tendency for the previously found differences to increase. It should also be realised that only a small part of the sample would be living at home; for example, of the students at University College, Swansea, in 1969-70 less than 7 per cent lived at home and the proportion would probably be smaller at Bangor and Aberystwyth. Nor would those living at home be confined to those whose homes were in the cities as these last two towns are not cities. The smallness of this percentage also demonstrates that travel is highly unlikely to be affecting the results since the vast majority of students live in halls of residence, lodgings or flats within a reasonable distance of the colleges. Holbraad (1962), using a sample of over 3,000 third-year students from most British universities, found no association between degree results and types of student residence or distance from the campus.

To sum up, this study opens up the possibility that students from city schools make the best progress in their first year at university, and those from schools in large towns of about 16,000 to 60,000 do worst, on average, while those from schools in smaller towns and villages fall between the two. Clearly, confirmatory studies are needed, as this finding is based on one area and some of the results, though consistent in trend, fall short of statistical significance.

It is important here to emphasise that in this study we have not been looking merely at differences in standard at university between students from rural areas, but at differences in performance in university first-year examinations between *students from those two areas who are equal in academic attainment on entry* and are matched on other variables. This might be termed difference in academic *progress* during the first year.

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(Manuscript received 13th September, 1971)

STATE, TRAIT AND CHANGE DIMENSIONS OF INTELLIGENCE

By J. L. HORN¹

(*Department of Psychology, University of Denver*)

SUMMARY. Methods for operationally distinguishing between generically different kinds of traits and states were described in some detail, prior to demonstrating the use of the methods to describe human abilities. The results indicated that a distinction between fluid intelligence, crystallised intelligence, broad fluency and broad visualisation exists primarily at the trait level, although states of fluency and visualisation were found to exist in attenuated form independently of reliable within-person variations in intelligence.

GENERAL THEORETICAL ORIENTATION

THE problem of isolating fluctuations in intelligence has considerable popular appeal. We are aware of our own short-period physiological, mood and motivational changes and it is not unreasonable to extrapolate this awareness to a belief that intelligence must undergo similar change. Recent theory and evidence on physiological arousal and brain mechanisms, when taken in conjunction with theory and evidence on the correspondence between brain function and behaviour, is not at all inconsistent with this view. However, the existing evidence does not provide support for an hypothesis that *behavioural* measurements of intelligence fluctuate over short periods of time in a reliable manner. To the contrary, this evidence suggests that measurements of intelligence are stable over both short and rather extended periods of time. The observed changes almost always have been interpreted as errors of measurement.

To say that intelligence is stable over time is to define it as a trait, much as one might define eye colour as a trait. In general personality theory a trait can be defined as a set of behaviours, evoked by designated measurement operations, which characterise differences between persons despite variation in time or in the circumstances in which people are observed. Thus, if intelligence is regarded as a trait and person A is intelligent relative to person B, then person A will evince more intelligence than B whether or not the two are observed in the mornings, the afternoons, the evenings, or after coffee or after cocktails, or in the winter or in the spring. A state may be defined by contrast as a set of behaviours which characterise differences between persons on a given occasion, but which differences are not stable from one occasion to another. Thus thirst may be indicated by a set of behaviours associated with dryness of mouth—such as licking the lips, raucous speech, movement toward a water source, etc.—but knowing that person A is more thirsty than person B on one occasion provides no basis for predictions that person A will be more thirsty than person B on other occasions. The differences between A and B are not stable, although the measurements on any given occasion may be highly reliable. This is an example of what can be referred to as a pure state, to be contrasted with a trait having, also, some state variability. An example of this latter might be something like arm strength, as measured by numbers of push-ups and chin-ups done in a standard unit of time. An individual A would usually be stronger than an individual B, but both would fluctuate in strength and on some occasions B could be stronger than A. Also, B might be developing strength more rapidly than A, in which case the rank order relationship involving A, B and other

subjects—D, E, . . . , N—would be changing over occasions even when A was consistently stronger than B. It would seem that this kind of model might well represent what is putatively known as intelligence. Yet, as noted, changes in measurements of intelligence usually have been interpreted as indicating only errors of measurement.

As a matter of fact, however, there are very few reports of studies which supply information about short-period changes in human performances, either those indicating intelligence, or those indicating other behavioural attributes. Horn (1963a, 1966) and Horn and Little (1966) have argued that one important reason for this dearth of research is that until recently there were virtually no methods for analysis which would enable the researcher to make the needed distinction between stable patterns of behaviours and reliable but fluctuating patterns. Only in the last few years have such methods been developed. Relatedly, since these methods involve complex (or, at least, involved) calculations with large batches of data, only in the last few years, with the advent of the modern computer, has it become feasible actually to use such methods.

Several distinct meanings can hide behind a phrase such as "short-period changes in attribute A (e.g., intelligence)." It is desirable to make a clean distinction between these meanings, for they have quite different implications for the study of personality.

When one speaks of short period changes in attribute A he may mean nothing more than unreliability—the fact that even when great care is taken to impose standard conditions in repeat measurements, there will be random unlawful fluctuations. In the present study there is concern with unreliability but only insofar as it obscures other kinds of change. The purpose is not to achieve high reliability, *per se*. Rather the aim is to identify change which, in accordance with concerns for parsimony, is not likely to represent error of measurement.

A second important meaning associated with an expression such as "short-period changes in attribute A" is that of a change which affects all (or nearly all) individuals in much the same way and which can be attributed to a more or less clearly specified causal agent. For example, it is known that if test-naïve subjects repeatedly take intelligence tests, their scores improve, at first markedly but progressively less as repeated testing continues. This effect has been ascribed to practice, to decrease in hampering emotional involvement with tests, to the learning of 'tricks' in marking answers and to other factors. In such causal explanations the focus is on factors believed to cause the change in all (or almost all) people. These factors are assumed to affect most people in much the same way: practice with tests is not assumed to cause one person to improve and another to get worse. The design for a study based upon this rationale typically has one group of subjects experiencing practice with tests and another but comparable group not experiencing practice. In the statistical analyses of data gathered in this way variability between subjects within treatments is treated as error—the variability with respect to which the differences between means for treatment groups is compared. If the between-groups estimate of variability is greater than the within-groups (between subjects) estimate of variability, the hypothesis of lawful change is retained.

But lawful change can exist and go undetected when this is the rationale and method for analysis. For example, if it happened that one half of a group of individuals became less emotionally involved and, for this reason, improved in performance as a function of experience with tests (the treatment), but one half of the group became more emotionally involved and, therefore, got worse in

their performance, the net effect recorded by the above-mentioned procedures could well be 'no change' and the lawful changes defined in the example would not be discovered.

This illustrates a case where there might be hunches in advance about the causes of the supposed change, but the fact of lawful change is not dependent upon prior knowledge. The same lawful change can occur whether or not we have an hypothesis stipulating that it will occur. Whatever their virtues on other counts, methods which are directed at testing more or less specific hypotheses have the limitation that they are not well-suited for the discovery of novel principles. An implicit assumption of the present study is that scientific investigation needs formal inductive, regularity-finding procedures for analyses, as well as the well-developed hypothetico-deductive procedures represented by inferential statistics.

Given that repeated measurements obtained with parallel forms of a test are different, that such measurements may fluctuate up and down in different ways for different subjects, and that this fluctuation is lawful, how is this variation to be distinguished from that which parsimoniously could be attributed to error of measurement? A direct approach to this problem is to establish internal consistency reliability *within* each occasion of observation and stability reliability across occasions and then argue that to the extent that the former is larger than the latter, reliable measurement of change is indicated. Although this approach involves some rather difficult practical problems of getting efficient and comparable estimates of reliability, it certainly is feasible and in detailed study of a particular variable probably should be used. However, it is not the procedure to be used here and, in fact, represents an entirely different metatheory about the nature of the attributes which constitute the elements of a scientific theory.

The metatheories that are referred to here are ways of thinking about the *formal* characteristics of the attribute which may be regarded as showing short-period changes. In one such theory an attribute is defined in terms of a particular operational representation, as by the scores obtained on a particular test. This is a univariate metatheory. It is the theory implicit in the statement above—the argument that changes in an attribute may be studied by comparing within-occasion and between-occasion coefficients of reliability. According to a second metatheory, however, an attribute is defined in terms of several operationally distinct and statistically independent components, or processes, each of which bears a systematic relation to the other. This may be termed a multivariate metatheory about attributes. It is the theory implicit in the analyses to be described in this report. The present study may be of interest primarily because it provides a novel attempt to deal with the problems of change and stability of personality attributes that are defined in accordance with the multivariate metatheory.

The central concept of the multivariate metatheory is that of functional unity, as defined by Cattell (1950, 1957). A functional unity is indicated by a configuration—a pattern—of processes which are themselves distinct but are integral parts of a more general process. To distinguish a functional unity from a mere collection of distinct processes it is necessary to show that the processes work together—that they rise together, fall together, appear together, disappear together or, in general, covary together. The action of the heart may be taken as an example of a kind of functional unity. The processes which might indicate this function are those recorded by blood pressure measurements taken in various parts of the body, breathing rate, skin moisture and skin

temperature. Each of the processes indicated by such measurements is distinct from the other and the intercorrelations among the process measurements will be less than unity even when corrected for unreliability. Yet the several processes work together in a way that gives evidence of the vital function and the function may be indicated by a pattern of covariation among the measurements of the separate processes. Similarly, the function of intelligence may be indicated by a pattern of covariance among distinct processes of memory, reasoning, abstracting, etc.

A functional unity is thus a rather high level abstraction. In operational terms it can be defined in a number of ways. One of the simplest such definitions is that furnished by the methods of factor analysis. According to this definition a functional unity is indicated by the set of variables which go together in the sense of correlating in a way that defines a particular factor. But it is necessary to distinguish between factors defined on measurements representing differences between subjects on a given occasion and factors defined on measurements representing differences between a subject on one occasion and that same subject on another occasion. The former are referred to as R-technique factors; the latter are usually called P-technique factors (Cattell, 1957, 1966). A functional unity, such as that representing heart action, can be identified in R-technique analyses, although it need not appear in such analyses, and it can appear in rather different form in R-technique as compared to P-technique analyses. Also a well replicated factor identified in R-technique analyses need not indicate a functional unity of the kind that would appear in P-technique analyses.

Consider the argument that heart function may be identified in R-technique analyses. This can occur if the differences between people in the various processes which indicate the function covary in much the same way as do the differences within each person. Thus, if when blood pressure is high in the arm, it is high in the leg, whether or not one measures several people on one occasion or the same person on several occasions, then essentially the same function can be described by analyses of either the between-person variance (R-technique) or the within-person variation (P-technique). However, it is possible for covariation to appear in within-person variation and not appear in between-person variation, as, for example, when correlations reflect time lags as blood pressure increases first in the upper part of the body and then in the lower part of the body. Similarly, it is possible for covariation to appear in analyses of between-person differences that would not appear in analyses of within-person differences. For example, a correlation between size of heart and slowness of heart beat might appear among measurements representing differences between people, but not appear (over short periods of time) among measurements of within-person differences. This would be true if heart size does not vary within persons.

In general, then, factors identified in R-technique analyses might or might not correspond to factors identified in P-technique analyses, and *vice versa*. If there is a correspondence between factors based upon the two kinds of analyses, there is evidence for a functional unity of a particularly interesting kind. For this correspondence implies that one can study the function either in comparisons of different persons or in comparisons over occasions in observing a given person. This not only provides for choice in method of study but also represents conceptual economy. Logically, however, it seems that such correspondence would be rare in study of the kinds of attributes which are of major concern in personality study. In the study of this kind of attribute too

many unknowns are free to vary independently. Yet it may not be over-optimistic to suppose that some of the processes which covary to define a factor in R-technique analyses will covary together to define a somewhat similar factor in variations within persons. In this event the former would represent a kind of snapshot—a single frame of the moving picture synthesised by within-person analyses. Comparisons of these two kinds of pictures present an opportunity for gaining an improved understanding of traits and function fluctuation of traits.

The purpose of this investigation is to study methods for distinguishing trait and state variability, defined within a multi-variate metatheory, and to see if intellectual abilities can be described in terms of both of these kinds of variability.

METHODOLOGICAL RATIONALE

A particular conception of change is to be given primary consideration in this study. This conception is one implying concomitant variation of several variables, but variation which is not accounted for by the fact that one individual is consistently different from another. Looked at in terms of our commonly-used R-technique breakdown of variance into components (Cattell, 1966), this conception may be represented by partitioning some R-technique components into two further components, viz., trait and state components, and by recognising that some R-technique components could, theoretically, represent state variation alone. Using the raw data representation shown in Figure 2, these ideas may be summarised as follows:

$$\begin{aligned} x_{jki} &= \underbrace{(t_{ji}T_{1i} + s_{jki}S_{1ki})}_{a_{ji}F_{1i}} + \dots + \underbrace{(t_{jq}T_{qi})}_{a_{jq}F_{qi}} + \dots + \underbrace{s_{jkm}S_{mki}}_{a_{jm}F_{mi}} + \dots \\ x_{ji} &= a_{ji}F_{1i} + \dots + a_{jq}F_{qi} + \dots + a_{jm}F_{mi} + \dots \end{aligned} \quad (1)$$

where x_{jki} represents an observed measurement obtained on person i using test (measurement operation) j on occasion k , and the symbols on the right represent the factors into which the observed score may be partitioned. In the lower section is a specification equation like that associated with traditional R-technique, single occasion factor analysis, in which it is not necessary to indicate occasion. Here, a_{jm} ($m = 1, \dots, M$) is the factor coefficient, representing the average (over subjects) extent to which test j involves factor m , and F_{mi} is the factor score, representing the quantity of factor m characterising person i . In the upper section, then, is a similar kind of specification equation, but one in which it is necessary to designate the occasion. Here t_{jq} represents the average (over both subjects and occasions) involvement of test j in a trait factor q , T_{qi} is a factor score representing the quantity of the trait q possessed by person i , s_{jkm} is a situational factor coefficient representing the extent to which test j measures a state factor m on the particular occasion k , and S_{mki} is a situational factor score representing the level of the state m in person i on this particular occasion k . It will be noted that in one case a factor F_{qi} corresponds to a trait, T_{qi} ; in another case a factor, F_{mi} , corresponds to a state, S_{mki} ; and in a third case a factor, F_{1i} , breaks down into both trait and state (function fluctuation) components, T_{1i} and S_{1ki} .

In both of the models represented in equation (1), it is assumed that what is referred to as common factors can be identified in actual experimental analyses by the fact that several variables involving a particular factor covary in the manner implied by the calculations of factor analysis. In traditional factor analysis this implies that on a given occasion persons with high scores on one test will tend to have high scores on the other tests which define the factor in question.

In the theory being developed here more than this is implied. It is implied, also, that in defining trait factors, persons with high scores on the tests of a particular factor on one occasion will tend to have high scores on these same tests on other occasions. In defining state factors the implication is that there will be reliable covariation among each individual's changes in score from one occasion to another.

A set of statistical-mathematical procedures for separating trait and state patterns has been suggested by Horn (1963b) and Horn and Little (1966), using derivations from multiple-discriminant analysis (Anderson, 1958; Tatsuoka, 1970). The principal rationale for these procedures can be stated fairly briefly. One essential idea is that several observations of a single individual may be regarded as a 'group,' quite analogous to, and mathematically equivalent to, a group of subjects (or skulls) in a usual application of discriminant function analysis. Discriminants, then, can be seen to have the same character as factors, only in this application they represent the linear composites which best, in a least squares sense, discriminate one person 'group' from other person 'groups,' despite the variations which occur within persons. Thus, these factors represent traits purged of state variability. States, on the other hand, are indicated by the occasion-to-occasion patterns of covariation within persons. Factors defined on such within-person covariations thus will be indicative of multi-process states, operationally independent of traits, as defined above. This rationale is developed in somewhat more detail in what follows in this section.

Consider a test j given repeatedly over K occasions to a set of I subjects. A linear combination of the scores obtained by subject i on the various occasions

$$x_{ij} = x_{ij1} + x_{ij2} + \dots + x_{ijK} \quad (2)$$

will have non-zero internal consistency to the extent that the scores obtained on any one occasion covary with the scores obtained on other occasions. The correlation of a variable with another variable is limited by the internal consistency reliability of that variable. Thus linear-combination scores of the kind indicated for test j in equation (2) can correlate with similar linear-composite scores for g to the extent that: (1) the scores for each test, considered separately, covary from one occasion to another, and (2) the scores for one test covary with the scores for the other test. The important point here is that the correlation between the two linear composites can tend to zero even when the correlations, r_{jgk} , obtained for these two tests on each and every one of the K separate occasions ($k=1, 2, \dots, K$) are high and have the same sign. This means that correlations between linear-composite measures like those of equation (2) give crucial information about traits. Indeed, if the intercorrelations among a set of linear composite measures of the kind indicated by equation (2) are all zero, but the inter-correlations among the measures obtained on each separate occasion are non-zero and about the same on each occasion, then the R-technique factorings of the correlation matrices for separate occasions indicate pure states—patterns, such as thirst, which are very well defined on any occasion, but which do not indicate stable differences between people.

To provide basic information about traits form a J by J matrix of inter-correlations among J linear-composite variables of the kind indicated in equation (2). A typical element in this matrix may be symbolised:

$$t_{jg} = \frac{1}{I} \sum_i z_{ij} \cdot z_{ig} \quad (3)$$

where the use of z indicates that the linear-composite variables (e.g., x_{ij}) have

been standardised. This violates no basic assumption implicit in the use of most psychological variables and does not eliminate variable levels of importance for the model being developed here. The use of t to symbolise the correlations in this case is intended to provide a mnemonic aid (t for traits). These co-efficients may be thought of as representing the variation essential for the identification of traits. The entire matrix of these co-efficients is conveniently designated T . If traits, thought of as factors among variables, do not exist, this matrix will tend to identity form, whereas to the extent that consistent trait influences do operate, this matrix will contain non-zero elements in the off-diagonal places and the factors for this matrix can represent stable traits.

When trait is defined in this way, it contains not only that which is stable from one testing occasion to the next, but also that which is predicted from one occasion to the next. Thus, if change in an attribute from occasion O_1 to O_2 is predicted in part by magnitude of the attribute on occasion O_1 , this regularity, also, along with that represented by lack of change over the occasions, is indicated by the covariance of equation (3). Predicted trait change of this kind would not be represented in the factors obtained on separate occasions, however. Thus, comparison of the factor determined on t_{ij} coefficients with factors determined on the correlations of separate occasions presents the opportunity of identifying change that is predicted by trait level.

Next consider each subject separately and the sample of K occasions upon which each is observed. Using this sample of occasions, we may compute what is usually referred to as the P-technique correlation for subject i thus :

$$w_{ijg} = - \sum_{k=1}^K z_{ijk} z_{igk} \quad (4)$$

where, again, the use of z indicates standardisation, this time over occasions for a particular subject. This standardisation means that the over-occasion scores (trait levels) are made the same for all subjects for which this kind of coefficient is computed. The co-efficient will be non-zero to the extent that score changes from occasion to occasion on the test j are accompanied by similar changes in score on the test g . Notice that a non-zero coefficient of this kind can occur either when : (1) the scores for subject i are consistently above the scores for subject h , or (2) the scores for subject i are sometimes above and sometimes below (i.e., inconsistently or randomly above and below) the scores for subject h , the case expected when some reliable state variability exists. The first condition represents function fluctuation, or systematic (e.g., learning) change, on a trait factor. The second condition represents what we have referred to as pure state. In either case, however, if the w_{ijg} coefficients are to be non-zero, there must be reliable change on the variables in question and change in score on one variable must be consistently accompanied by similar change on the other variable. In other words, if changes in scores on tests j and k represent only errors of measurement, then the w_{ijg} coefficients will tend to zero.

A difficulty with this reasoning, and a difficulty with P-technique generally, is that it is based upon the observations of only one subject. Any conclusions one can draw from a P-technique analysis are very much weakened by recognition that one case can be quite atypical in relation to the expression of a general law. Error can too readily be associated with observations on a single subject. However, if the coefficients of equation (4) are pooled over I subjects and I is large, these objections lose their potency. The expected mean over I for the

distribution w_{jg} coefficients is zero and the standard deviation for this distribution should approximate the standard error for correlations based upon samples of size K in the case where the correlation in the population is zero. Thus, if the observed variability indicates only error of measurement, then w_{jg} coefficients formed by pooling over subjects

$$w_{jg} = \frac{1}{IK} \sum_i \sum_k z_{ijk} z_{igk} \quad (5)$$

should be approximately zero. To the extent that this is true for all variables under consideration, a J by J matrix, W , of such coefficients will tend to identify form. In contrast, to the extent that a set of tests reliably measure the same *changes* within subjects, whether or not this is function fluctuation of traits or pure state, the w_{jg} coefficients for these tests will be non-zero and W will not have identity form. This can occur: (1) when the tests in question measure pure states—the condition existing when it is purely a random matter for one subject to be above another in scores on the various tests defining the factor, or (2) when the tests measure traits but traits which have some reliable function change. This latter change can be either unidirectional, as when subjects learn at different rates, or vacillating, as when subjects first improve, then get worse, then improve again, etc.

The T and W matrices go a long way towards providing us with basic summary statistics upon which to base multivariate analyses aimed at disclosing the nature of change and invariance in a set of variables. Factors derived from the coefficients of T provide a firm basis upon which to base an inference about traits and the factors obtained from W indicate states and function fluctuations on traits if such patterns exist. But there is some confounding of state with trait and *vice versa* in these identifications. This is true mainly because in actual applications K is likely to be small, for various practical reasons, and occasions are not likely to be as independent as was implied in developing our model. If tests j and g measure only a pure state, but adjacent occasions are not sufficiently separated in time to allow the state to dissipate in one individual and build up in another, then the T matrix will contain some covariation indicating this fact and likely to be misinterpreted as trait variance. But now this kind of consistent variability is also picked up in the W matrix. Hence, it can be argued that if this variability recorded in W is eliminated in T , the factors then resulting will provide a purer basis upon which to base an inference of trait. A statistical rationale based upon this kind of reasoning follows from a consideration of the principles of discriminant function analysis.

A set of occasions for a particular subject may be viewed as a 'group,' analogous to a group in the usual developments and applications of discriminant analysis. That is, just as we can regard K school boys as a group distinct from a group of K school girls, so one individual on K occasions may be regarded as a 'group' of himself, so to speak, distinct from a 'group' of a second individual observed on K occasions. The J measures obtained on these one-person 'groups' then constitute a basis for describing differences between 'groups.'

A discriminant is a linear combination of measures which best (in a least squares sense) separate (i.e., discriminates between) groups despite variation within the groups. A discriminant among 'groups' comprised of repeat observations on each particular individual is thus a linear combination which best separates individuals despite variation within individuals. This is the essence of the definition of trait developed above. Hence, discriminants among

one-person 'groups' constitute a basis for definition of traits, as is argued in somewhat greater detail elsewhere (Horn, 1963a; Horn and Little, 1966).

The result of deriving discriminants, following the usual procedures (Horn and Little, 1966), is to determine principal components (i.e., factors) on a T matrix modified by being premultiplied by the inverse of a 'within-subjects' dispersion matrix of the form of the W matrix defined above; that is,

$$B = W^{-1}T \quad (6)$$

where it can be seen that if W happened to equal T , the resulting B would be an identity matrix. Thus, to the extent that the pooled covariation within subjects differs from the between-subject co-variation among scores obtained by summing over all occasions, the off-diagonal elements of B will be non-zero and there will be common factors. These factors are indicative of pure trait—i.e., patterns of covariability from which consistency brought about by lack of dissipation of state has been removed.

The intercorrelations among several measurements obtained on a given occasion can be non-zero because (1) the same stable trait is represented by the several variables; (2) the same pure state is represented by the several variables; (3) the same function fluctuation of a trait is represented by the several variables. If only one occasion is involved, a fourth possibility must be considered: the correlations may indicate a pattern of influences specific to the occasion. However, if the correlations are averaged over 1, 2 . . . k , . . . K occasions, as

$$S = \frac{1}{K} \begin{bmatrix} K \\ \Sigma \\ k \end{bmatrix} R_k \quad (7)$$

then the influences associated with specific occasions will tend to be cancelled out, particularly if K is large. Then only the influences indicated as (1), (2) and (3) will operate to produce factors. If the averaged (over occasions) correlation matrix S , and the factors of this, are compared with the correlation matrix based on total scores T , and the factors of this, the following possibilities can be considered:

(1) Trait alone operates. In this case S should be very similar to T . The only difference that will appear (other than that due to random influences) is in the absolute magnitude of the intercorrelations: because the variables being correlated in T are obtained by summing stable trait scores over K occasions, whereas the scores being correlated to yield R_k (and hence S) are obtained over only one occasion, the variables of T should be more reliable than those of S and the correlations involving the variables of T should be uniformly larger than the average correlations obtained in S . This implies that S will be proportional to T , the constants of proportionality being the amounts by which the reliabilities of the variables are increased by making them K times as long. This might be expressed as

$$T = P S P \quad (8)$$

where P is a diagonal matrix containing non-zero elements representing the Spearman-Brown increments to reliability and intercorrelation produced by lengthening the variables. This implies that the factors of S will be proportional to the factors of T . That is, if F are the factors of T and A are the factors of S the implication is that

$$F = P A \quad (9)$$

where, in general, the P values are greater than 1.0, thus indicating that the factor loadings for F are systematically larger than the factor coefficient for S .

(2) Pure state alone operates. In this case, as noted previously, T should tend to identity form and S will contain non-zero elements in the off-diagonal positions, these representing the patterns of variables which consistently, despite change in circumstances (occasions) indicate the states. More generally in this case the factors of S and T will be quite different. The factors of S will indicate states, and thus will match closely with the factors of W . The factors of T will, where the number of occasions is large, indicate only random variation. When the number of occasions is small, random influences will not fully cancel and some variability due to state may still reside. Even in this case, however, the factors of T will have small variance relative to the factors of S .

(3) Trait and state or function fluctuation operate. In this case, S will represent both state and trait influences. To some extent, then, the factors of S should match with the factors of W even when the latter do not match with the factors of T or B . The similarity between the factors of S and W will reflect the extent to which state patterns replicate on successive occasions, as represented by the pooling of separate-occasion R_k matrices. But to some extent, also, the factors of S should match with the factors of B or T . This will indicate the extent to which the trait patterns replicate on successive occasions. There is also suggestion here that if states are not defined by the same patterns of variables as traits, then since S represents both states and traits, whereas B represents only traits and W represents only states, S could be expected to involve more factors than B , T or W . Thus, analyses of S can provide a kind of bridge between the analyses of T and the analyses of W .

These proposals for analyses constitute the methodological rationale for this study. It was proposed that if observations were obtained in a way which would allow for computation of T , W and S matrices, then factor analyses based upon these matrices directly, and discriminate factor analyses based on $W^{-1}T$, should provide a basis for describing variables in terms of the extent to which they measure traits and states when these are defined in accordance with a multivariate metatheory.

SUBSTANTIVE RATIONALE

As was stated in the introductory section of this paper a major purpose of this study was to describe the state-like and trait-like characteristics of human intelligence. However, when one looks for evidence that intelligence is a functional unity (in at least the R -technique sense of this concept) he finds that there is good reason to suppose that there is not one such function, but two. The evidence on this point has been reviewed rather extensively by Horn (1967b, 1968, 1970, 1971, 1972). It can be summed up by noting that two very broad factors have been identified among variables which are widely accepted as indicants of intelligence and these two factors are not only psychometrically independent; they appear to have different construct validities when studied within the context of developmental, physiological and general personality variables.

One of these factors is interpreted as indicating what is called fluid intelligence, symbolised G_f . This involves reasoning of a variety of kinds—inductive reasoning with symbolic materials, conjunctive reasoning with semantic materials, pattern reasoning with figural materials—as well as span of apprehension and a variety of other skills. However, its most distinctive

characteristic is that the measures which define it are relatively culture fair in the sense that extensive formal education or, more broadly, acculturation does not greatly help those who have it or greatly hinder those who do not.

The second intelligence factor is referred to as crystallised intelligence and is symbolised Gc. This is similar to Gf in the sense that it involves reasoning, abstracting, relation-perceiving and other processes commonly accepted as indicative of intelligence, but it differs from Gf in that the tests which define it clearly do represent extent of acculturation.

The measurement distinction between Gf and Gc can be illustrated with test item examples. Thus, consider the following two analogic reasoning problems, both of which are indicative of conjunctive reasoning with semantic materials (a primary factor known as CMR, Cognition of Semantic Relations).

Broom-Floor :: Spoon—	Fork	Table	Soup	Dish
Hippocrates-Galen :: Aeschylus—	Greece	Euripides	Pericles	Plato

Both problems are to some extent ambiguous in the sense that one might adequately defend more than one answer. Yet it is evident that both require ability to perceive relations. However, the first problem involves fundamentals—i.e., concepts represented by words—with which most adults in this country would be familiar, whereas the second item contains fundamentals with which many adults could not be at all familiar. Yet it is clear, too, that if one knows the referents for the words in question, the analogies are of about equal difficulty. Thus, both problems allow for measurement of a reasoning ability that is indicative of intelligence, but the second problem, to a greater extent than in the first, measures a component of intelligence which reflects extent of acculturation.

In this example the acculturation which helps in the solution of the second problem is that which acquaints one with the concepts of early Greek and Roman cultures. However, acculturation can also operate to produce problem solving skills, termed aids. Thus, consider this problem:

The cable of a suspension bridge hangs between two pillars that are 390 feet apart. The lowest point of the cable is 50 feet below the point of suspension. What is the angle between the cable and the supporting pillars?

One might solve this problem by reasoning which did not depend upon using the procedures of calculus, but it is probably most easily and quickly solved by framing the problem in terms of an algebraic function and finding the derivative of this function. These are procedures which have been developed by the creative reasoning of persons of the past and deposited in what might be called the collective intelligence of our culture. To use such procedures (termed compensatory aids, since they can compensate for limitations in untutored reasoning processes) is to exercise intelligence; but intelligence which one has appropriated from his culture. It is this kind of acculturation which enters into the expression of the intelligence that is identified as crystallised intelligence.

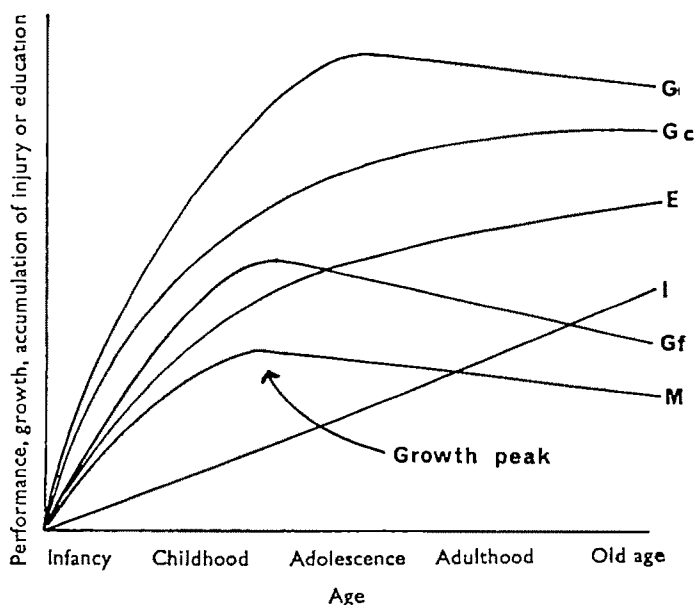
The evidence which has accumulated thus far on these two forms of intelligence suggests that they take rather different paths of development. These paths are depicted in Figure 1. In the earlier years of life, the two are indistinguishable. But as development proceeds a variety of influences operate to perpetuate the intensive acculturation which produces high development of Gc in some, while incidental learning and the healthy development of the physiological base operate to produce favourable development of Gf in others. By late adolescence the two forms of intelligence are clearly separable. In adulthood the acculturational base which has built up in Gc continues to support

further development of this form of intelligence. Thus, G_c tends to increase, or at least not decrease, in adulthood. But, as physiological-neurological anabolism slows to a halt, the war of attrition which environmental conditions wage against physiological structures begins to record its toll. This shows primarily in those intellectual functions which have not been over-determined neurologically and greatly elaborated by, and supported by, the compensatory aids and concepts developed through intensive acculturation. Also, inherent catabolic influences may work to destroy the physiological base which supports these functions. In either case, since a major portion of the variance of fluid intelligence reflects the adequacy of these functions, G_f begins to show decline fairly early in adulthood, as the physiological base for intelligence is whittled away.

Whether or not these explanations tell the full story, the evidence suggests that the curves of decline for G_f and G_c in adulthood are different and at least roughly of the form indicated in Figure 1. Other evidence suggests that loss of central nervous system structure produced by factors other than those associated with ageing—as for example, leucotomy—is recorded most surely in irreversible decline in fluid intelligence—and when decline in G_c may not be noticeable or permanent (Hebb, 1942, 1949; Horn, 1970; Porteous, 1965).

FIGURE 1

DEVELOPMENTAL CURVES FOR FLUID AND CRYSTALLISED INTELLIGENCE.
(after Horn, 1970)



G = Overall Intelligence Ability = $G_c + G_f$.
 G_c = Crystallised Intelligence.
 G_f = Fluid Intelligence.
 E = Acculturational Exposure.
 M = Maturational Growth and Decline
 I = Injury to Neural Structure.

There is thus the suggestion in this kind of evidence that Gf, relative to Gc, is the more immediate indicant of the adequacy of the on-going physiological-neurological processes which support the expression of intelligence. If this is true, then it might be supposed that if intelligence does, in fact, fluctuate over relatively short periods of time, the fluctuation reflects reversible changes in function of physiological-neurological processes and these will show up most surely in changes in fluid intelligence. Hence, if Gf and Gc can be identified as function fluctuation patterns (for, clearly, they are not pure states), then for Gf, relative to Gc, a relatively larger proportion of the reliable variance should be accounted for by function fluctuation and a relatively smaller proportion of pure trait. This idea, plus simply the hypothesis that function fluctuation and trait patterns for Gf and Gc could be identified, provided the principal motivation for the substantive aspects of this research.

Although it might seem enough for this study to distinguish two forms of intelligence which might show function fluctuation, still the available evidence suggests that one could readily be led astray by analyses based only upon measures which indicate Gf and Gc as patterns of distinct processes. For this evidence indicates that broad functions other than those represented by Gf and Gc enter into performances that are accepted as indicating intelligence. In particular, many intellectual tasks appear to involve a broad visualisation function (symbolised Gv) which is psychometrically independent of Gf and Gc and which shows a somewhat different developmental curve than either of these forms of intelligence (Horn, 1970; Horn and Cattell, 1966a, 1966b). Yet some of the performances which indicate this Gv function also have variance in Gf. This means that unless a study design allows for the possibility of distinguishing Gf from Gv, the two factors could be confounded in one. Then any observed function fluctuation in this factor might be due to either Gf or to Gv or to both, and the investigator would have no basis for dealing with these possibilities. In other words, unless the variance associated with Gv is accounted for, results supposedly showing trait and state characteristics of Gf might better be interpreted as indicating state and trait characteristics of Gv. Thus, to provide some control over this kind of misinterpretation, this study was designed to permit distinction between Gf and Gv if, indeed, trait and function fluctuation patterns for these two constructs are empirically distinct.

In addition to Gv, previous research has indicated a broad fluency factor (termed F) which, in some forms, can be confused with Gc. The F function is shown most clearly in tasks where speedy production of ideas is required (see, particularly, Rossman and Horn, 1972). It appears to represent what many theorists are referring to as creativity, when this latter is conceived of as being independent of intelligence. In fact, in the Rossman-Horn (1972) study, this fluency factor, in comparison with other factors which might be interpreted as indicating creativity and in comparison with Gf and Gc, showed the most consistent pattern of correlations with rating and life-record measures of creativity.

The broad fluency factor is co-operative with Gc and, partly for this reason, it has been interpreted as representing a storage compartment of intelligence. It is reasoned that as concepts are learned they are stored, as it were, somewhere in the individual's system and the F factor reflects the size of this storage compartment, it being assumed that the larger the store of concepts, the more elements (ideas) that can be taken from the compartment in a unit of time. However, it is certainly possible that broad fluency does not represent the size of the store of concepts so much as it represents speed of transmission of ideas

from the storage compartment to the production modalities involved in speaking and writing. Perhaps, particularly if the latter were true, a considerable proportion of the variance in F might be attributable to function fluctuation. In any case, since F can be confused with Gc and failure to distinguish it from Gc might lead to confounding its trait and function fluctuation properties with those of Gc, this study was designed to allow a distinction to appear between F and Gc if, in fact, two such functions are separable.

In sum, then, it is proposed that measures of processes which have indicated the functional unities symbolised as Gf, Gc, Gv, and F be obtained over several occasions and that the analyses described in the section on methods be directed at showing whether or not these functional unities can be defined both as traits and as function fluctuation patterns (states). If they can be so defined, analyses will also be directed at describing and comparing the extent to which the functions are stable, or trait-like, and the extent to which they fluctuate, or are state-like.

PROCEDURES

(1) *Operational Definitions of variables.*

The prior research mentioned above established a basis for selection of variables but did not provide a complete sample of the measurement devices needed for this study. This is because most of the prior research was based upon single-occasion testing. Only rarely did it result in the construction of more than two forms of a test found to define a factor. Therefore, one of the first major tasks of this study was to construct several alternative forms of the tests which previous research had established as probable markers for the general factors of principal concern.²

In Table 1 are listed the tests actually developed. The titles for the tests are meant to be descriptive of the performance involved and are not necessarily the same as the titles used for the same tests in other studies. The column designated 'source' in this table includes either the name of the person who invented the test or, if not this, the name of the person who developed most of the items incorporated in the tests used in this study.

In the Primary Factor column are listed the currently used titles for the primaries which tests represent. These titles and the symbols in the next column were taken from French (1951), French, Ekstrom and Price (1963) or Guilford and Merrifield (1960).

The reliabilities listed in the Avg. r_{xx} column are Spearman-Brown corrected split-half coefficients averaged over three of the 10 sessions. Two separately timed sub-forms for each test were given on all 10 sessions. For the first, fifth and tenth sessions the two separate forms were intercorrelated. For each particular set of two forms the resulting three intercorrelations were averaged. Then, because the scores for the two forms were added together to provide the score actually used in analysis, the Spearman-Brown formula was applied to the average correlations to give an estimate of the reliabilities of the full-length variable.

The reliabilities obtained in this way are internal consistencies, not stability coefficients. Also, since the separate sub-forms of the tests were put together somewhat arbitrarily and cannot, therefore, be expected to be perfectly parallel in the psychometric sense of this term (Gulliksen, 1950) the reliability estimates should be regarded as slight under-estimates of the true internal consistency reliabilities. It follows that in some cases the communalities for variables can be expected to be larger than the estimated reliabilities.

In the *scoring* column of Table 1 are listed several symbols to indicate the operations whereby a score was obtained for a subject. 'R' means that the number of responses judged 'correct' is the score. In a very simple test, such as 'Encircling Numbers,' this is the same as the number of responses made in accordance with directions. If the task was to draw a circle around all number 9s in a row of numbers, score was the number of 9s encircled. In this example no credit would be given if the number 8 were encircled, but no points would be subtracted for this failure to follow directions. In a test such as analogies, an answer judged correct represents the reasoning of the test constructor and is somewhat arbitrary for this reason. For example, in the scoring of the analogy: Hippocrates-Galen :: Aeschylus-Greece Euripides Pericles Plato, it is assumed that the essential relationship between Hippocrates and Galen is that of the occupational activity for which they are mainly remembered (both were physicians of a sort) and that the choice of answer should depend upon perception of a similar relationship between Aeschylus and one of the choices. The letter 'W' in the scoring column indicates that a score was obtained by counting the number of responses judged to be 'wrong' or irrelevant. In the Controlled Associations test if one responded with the word 'Fly-paper' to the key word, 'Warm,' the answer would be judged wrong. The letter 'K' in the scoring column indicates that the Memory-For-Designs test was scored according to a key based upon a different rationale than those outlined above. The instructions for scoring this test are provided in a manual prepared by Graham and Kendall (1960).

In the last two columns of Table 1 are listed the numbers of items and work times for the single-occasion forms of the tests. Number of items on the highly speeded tests does not mean the number that really could be attempted. In the Placing Dots test, for example, 300 small circles were presented, but no subject could really be expected to locate a dot in each of these circles in the time allowed (90 seconds).

TABLE 1
DESCRIPTION OF TESTS AND PRIMARY FACTORS.

Test Name	Source	Primary Factor	Sym- bol	Avg. r_{xx}	Scor- ing	No. Items	Work Time (Secs.)
1. Encircling Numbers...	Moran ..	Perceptual Speed...	P	71	R	475	90
2. Placing Dots	Moran ..	Aiming	A ₁	90	R	300	90
3. Following Paths	Moran ..	Visualization	V _z	93	R	80	180
4. Copying Designs	Moran ..	Flexibility of Closure	Cf	81	R	36	130
5. Figure Series	Cattell ..	Figural Relations ..	CFR	62	R	6	150
6. Dominoes (D48)	Black...	Deduction	D	70	R	6	—
7. Remembering Digits ..	Horn	Memory Span	Ms	85	R	14	80
8. Remembering Designs.	Graham ..	Memory Span ...	Ms	52	K	2	120
9. Letter Series	Horn	Induction	I	84	R	7	200
10. Verbal Analogies	Horn	Semantic Relations..	CMR	76	R	8	180
11. Remote Associations ..	Mednick .	Originality	O	48	R	10	150
12. Controlled Associations	Thurstone	Associational Fluency	F _a	77	R	2	90
13. Things	Taylor ..	Ideational Fluency ..	Fi	65	R	1	180
14. Vocabulary	Horn	Verbal Comprehension	V	58	R	10	150
15. General Information ..	Horn	Verbal Comprehension	V	67	R	6	150
16. Irrelevant Associations	Horn	Careful Association ..	F _r	71	W	2	130

Where more than one test was used to measure a primary factor, the scores for the separate tests were converted to standard score form and added together to provide the primary measure that was used in analysis. Measures were standardised separately within each session. This was done because although differences in the means and sigmas for different occasions might be significant (when analysed by means of an analysis of variance, for example), the interpretation of these differences could not be unambiguous. The primary factor tests, although conceptually parallel, were not constructed in a way to ensure that they would necessarily be psychometrically parallel (Gulliksen, 1950). Hence, significant differences between occasions could represent only the fact that forms of a test varied in difficulty or discriminability: such differences need not represent any change in the subjects measured. Also, since the principal purpose of this study was to classify subjects according to patterns of change, not study changes common to all (or most) people of a group, the overall differences between sessions could be eliminated.

(2) *Data-gathering Procedures.*

The measurements indicated above were obtained on 10 separate occasions for each of 106 male inmates at the Colorado State Penitentiary.³ The tests were administered to groups of about 10-15 subjects. The first testing session began at about 9-30 a.m. on Monday of a given week; the second session began about 1-0 p.m. on the same day. Eight sessions followed—one in the morning and one in the afternoon (at about the times indicated) on each day, Tuesday through Friday. The first testing session lasted approximately two hours. The sessions after this were somewhat shorter due to the fact that instructions could be given more quickly after the men gained initial familiarisation with the tests.

The men who completed all sessions were paid \$2.00 for their efforts. Only two of those who started the testing failed to complete all sessions. Motivation appeared to be quite good throughout the testing, although it seemed to lapse slightly in mid-week relative to the other days and in afternoons relative to mornings. However, these were only impressions, not observations corroborated by analyses of data.

The generally high motivation was no doubt due in part to the financial incentive offered for completion of the tests. Two dollars may not seem like much for the amount of work done, but in the economy of the prison, it is a good deal more than it seems to be when considered within the economy outside the prison. The jobs a prisoner can work at to provide funds for cigarettes, books and magazines, gifts, etc., pay approximately 10 cents per day. Many of the men get very little, or no, money from outside the prison. The men who participated in this study did not lose the income from their regular jobs.

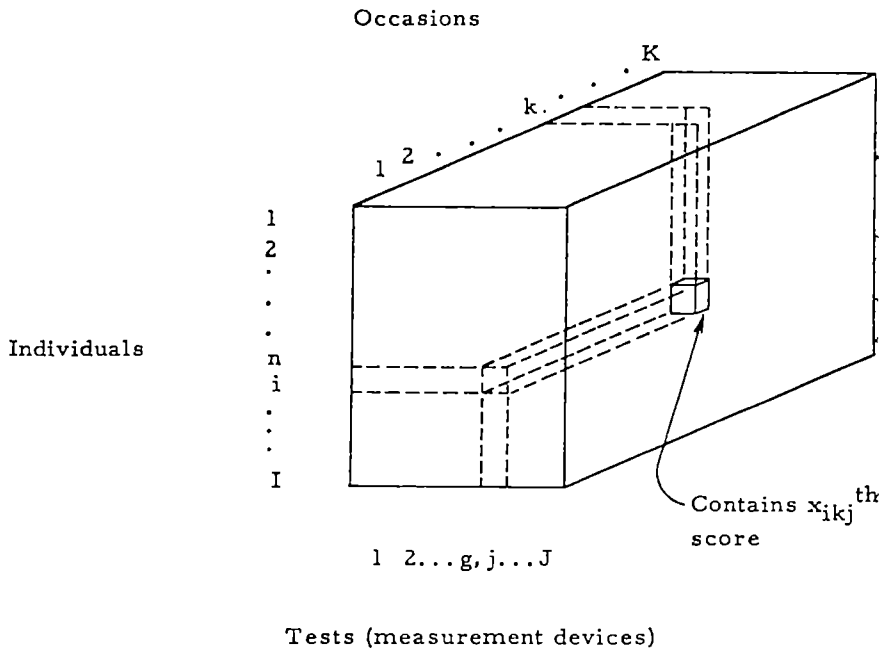
(3) *Analyses.*

The data-gathering and scoring procedures described above provide measurements of 14 primary mental abilities on each of 10 occasions for each of 106 subjects. These data may be regarded as set out in the data box shown in Figure 2. The grids within this box define cells in which are located separate scores; the depth, width and length dimensions of the box correspond, respectively, to the number of subjects, the number of primary variables and the number of occasions.

Notice that the grids within the data box mark off matrices. It is helpful to refer to these as files which might be drawn out separately, as from a file cabinet. Thus, the front face of the box, representing the first front-vertical (as opposed to side-vertical) file, would, in this study, be a 106-by-14 matrix containing primary factor measurements obtained on the first occasion—a matrix of the kind involved in a typical R-technique single-occasion factor analysis. If the box is approached from the top, the first horizontal file is a 10-by-14 matrix such as would be used in a P-technique analysis for one subject.

FIGURE 2

THE DATA BOX: A REPRESENTATION OF MEASUREMENTS OBTAINED IN THE STUDY OF CHANGE AND INVARIANCE.



Product-moment intercorrelations between primary factors were obtained separately for each of the 10 occasions—i.e., on each of the 10 front-vertical files described above. The resulting correlation matrices (symbolized R_k , where $k=1, 2, \dots, 10$) were added together and the sum was divided by 10 to produce the within-sessions correlation matrix, S . Levin (1966) has recently pointed out that the factors of this matrix provide one kind of best-estimate of factors to reproduce the individual R_k matrices which go into the sum.

Each subject's standard scores on a particular primary were summed over the 10 occasions and the resulting total scores for the primaries were intercorrelated. The matrix obtained by these operations is the T matrix referred to in the section on methodological rationale. According to the reasoning advanced in that section, T provides the principal statistics upon which to base the definitions of factors representing traits.

The W correlation matrix was obtained from the horizontal files taken by approaching the data box from the top. The 14 primary factors were inter-correlated for each subject separately, using the 10 occasions as the sample. The resulting 106 correlation matrices were summed and the result was divided by 106. The W matrix provides a basis for defining factors of function fluctuation of traits.

The S , T and W matrices were factored initially by a principal components procedure described by Horst (1965, p. 165 ff), who credits Tucker (1944) with developing the method. It is a successive vector approximation method appropriate for symmetrical correlation (covariance or cross-products) matrices. To estimate the number of factors the so-called (by Horn, 1965) Kaiser-Guttman-Dickman rationale was used. This indicated four factors for the S and T matrices, but five factors in the W matrix. Since the latter provided for the least reliable determination of the correlations and was, therefore, likely to be most affected by least-squares capitalisation on sampling error, it was reasoned (in accordance with Horn's (1965) rationale for estimating minimal rank statistically) that the number of factors which could be reliably estimated in all matrices would be no more than four. Thus four factors were estimated in all solutions.

Although the S , T and W matrices are symmetric and, therefore, their inverses are symmetric, the product matrix $W^{-1}T$ is not symmetric. To obtain the factors for these matrices a procedure described in a programme provided by Cooley and Lohnes (1962, p. 206) was used. This method amounts to obtaining all of the roots and vectors for W , substituting the resulting expression for W back into the characteristic value problem, multiplying through and re-arranging terms to get a symmetric matrix the roots of which are the roots of $W^{-1}T$ and the vectors of which can be rescaled to be the vectors of $W^{-1}T$. Thus, if H is the matrix containing all of the orthonormal characteristic vectors of W and M is a diagonal matrix containing the corresponding characteristic roots of W , then the characteristic value problem, derived as

$$(W^{-1}T - gI)V = 0 \quad (10)$$

in the Horn (1963a) and Horn and Little (1966) papers can also be expressed as

$$(T - gW)V = 0 \quad (11)$$

(where V is a characteristic vector and g is the scalar $V'V$). This latter can be seen to be expressed in terms at the roots and vectors of W , thus

$$\begin{aligned} (T - gHMH')V &= 0 \\ TV - g(HM^{\dagger})'(HM^{\dagger})'V &= 0 \end{aligned} \quad (12)$$

One may multiply this on the left first by H' and then by $M^{-\dagger}$ and factor out V to obtain

$$[M^{-\dagger}H'T - g(HM^{\dagger})']V = 0 \quad (13)$$

in which it can be seen that one may factor out the $(HM^{\dagger})'$ term, provided he also multiplies T on the right by $[(HM^{\dagger})']^{-1}$ to keep the equality. This will then simplify to

$$[M^{-\dagger}H'THM^{-\dagger} - gI](HM^{\dagger})'V = 0 \quad (14)$$

a characteristic value problem in which the matrix

$$C = M^{-\dagger}H'THM^{-\dagger} \quad (15)$$

is symmetric and the vectors of C (namely $(HM^{\frac{1}{2}})'V$) bear a relatively straightforward relation to the vectors of $W^{-1}T$ (namely V). Thus, by calculating all of the roots and vectors of W , forming the square matrix $HM^{\frac{1}{2}} = P$, calculating the minimum rank roots and vectors of C , and rescaling these vectors by $(P')^{-1}$, one can obtain the vectors of $W^{-1}T$.⁴ Using the solutions for T , S and W as the guide for estimating minimum rank, four factors were estimated for the $W^{-1}T$ matrix.

The solutions for T , S and $W^{-1}T$ were obtained without altering the principal diagonal elements. Thus, the solutions for T and S may be regarded as truncated principal components solutions (truncated because not all components were extracted) and the solution for $W^{-1}T$ is a truncated discriminant function solution. A truncated principal components analysis was tried also for W , but this did not provide a satisfactory solution: the reproduced correlations obtained by this procedure were considerably larger than the obtained correlations. Communalities were, therefore, estimated for this matrix through 36 iterations of the vector estimation procedure described above. Beginning with unities in the diagonal, iterations were continued until no communality on one calculation differed by more than .001 from the communality obtained on the just-previous calculation.

Each of the four sets of factors was rotated to achieve an approximation to simple structure by application of Kaiser's (1958) Varimax criteria. Oblique rotation was also carried out, but the results from the Varimax solution provided essentially the same basis for writing conclusions as did the oblique results (in agreement with the findings of Horn, 1963b). Since there is no need to list table of factor intercorrelations with the Varimax factors and the associated summary statistics (factor variance contributions) are easier to calculate and interpret for these than for the oblique solutions, the Varimax factors were accepted as the final solution.

The T , S , W , $W^{-1}T$ matrices, the principal axes and the oblique solutions for these, and factor intercorrelations, have been filed with the National Auxiliary Publications Service.⁵ The Varimax factors and variable communalities are listed in Table 2. In the bottom three rows of this table are contained the variance contributions of factors, these contributions expressed as percentages of total variance, and these contributions expressed as percentages of the common variance. It will be noted that, in general, the factors are not listed in order of variance contribution. The order of variance contribution is different for the different solutions, as would be expected if the functions which the factors represent differ in the extent to which they are state-like and trait-like.

Corresponding factors in the different solutions were matched as well as possible by inspection. This proved to be an easy task in comparing the results for the analyses on the T , S and $W^{-1}T$. However, it was difficult to match the factors obtained from W . Coefficients of congruence (Burt, 1941) were obtained to provide a descriptive index of the relationship between corresponding factors of different solutions. These are provided in Table 3.

TABLE 2

VARIMAX FACTORS, COMMUNALITIES AND VARIANCE CONTRIBUTIONS.

	T-Traits					W-T-Traits					S-Trait-State					W-State				
	I	II	III	IV	h ²	I	II	III	IV	h ²	I	II	III	IV	h ²	I	II	III	IV	h ²
P.....	00	03	80	10	65	-12	05	63	04	42	-02	03	79	09	63	02	10	09	03	02
Al.....	31	07	65	22	57	10	-06	38	02	15	54	-01	33	19	44	07	18	13	08	03
Vz.....	32	08	77	12	71	01	-01	48	-04	23	40	04	62	10	56	03	-02	63	04	41
Cf.....	61	35	41	22	71	38	01	00	-02	14	54	29	37	21	52	-05	08	36	03	14
CFR..	75	15	37	00	72	47	-24	11	-09	30	57	20	15	-08	39	-06	20	00	01	04
D.....	51	53	36	01	67	46	08	07	-05	23	27	55	28	-08	46	68	-07	-03	00	46
Ms.....	78	00	02	23	66	45	-31	-16	08	33	73	00	-20	20	62	-05	03	04	12	02
I.....	62	51	27	24	78	37	09	00	05	15	45	47	10	14	45	06	17	03	08	04
CMR..	47	61	06	43	77	30	22	-15	17	19	26	44	-06	39	41	-06	19	08	00	05
O.....	01	85	09	-03	74	-03	62	01	-13	40	00	72	04	00	52	12	34	02	05	14
Fa.....	26	48	10	74	85	07	06	-09	54	31	13	47	06	64	59	04	12	03	44	21
Et.....	11	37	30	78	80	-06	09	12	50	28	10	25	22	67	57	04	06	10	20	06
V.....	15	80	-04	28	74	10	57	-06	10	28	04	67	-09	27	52	10	08	02	02	02
Fr.....	11	-08	12	89	82	00	-25	01	73	59	08	-15	04	70	52	02	14	10	-54	32
Var. ..	272	277	230	243	1022	104	094	087	115	400	198	205	142	174	720	051	030	059	056	196
% Tot.	19	20	16	17	73	07	07	06	08	29	14	15	10	12	51	04	02	04	04	14
% Com.	27	27	23	24	—	26	23	22	29	—	28	29	20	24	—	26	15	30	29	—

TABLE 3

NOTEWORTHY CONGRUENCE COEFFICIENTS*

	T-Traits				W-T Traits				S Trait-State			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
W-T I.....	95	52										
II.....		74										
III.....			86									
IV.....				94								
S I.....	96		64		86							
II.....	56	99			55	73						
III.....			94				92					
IV.....				99				93				
W I.....		46			36					51		
II.....		72	40	52	39	43			46	68		51
III.....	53		72				56	34	55		68	38
IV.....	45									35		
	32											

* In most cases only coefficients larger than .50 are listed. But in the case of W, where the match with other factors is not clear, coefficients larger than .30 have been listed.

INTERPRETATION AND DISCUSSION OF RESULTS

It will be useful to first identify the factors in the analyses for traits, then go on to consider similarities in the results from different solutions and finally turn to considerations of differences between solutions. This will enable us to relate the results from this investigation to findings obtained in previous studies and to build upon this base in identifying patterns of function fluctuation. If trait patterns in this study can be linked to patterns identified in single-occasion (trait or state) studies of the past, then to the extent that there is similarity across all solutions in this study there is evidence that the traits and states (function fluctuations) are manifested by the same patterns of variables or functions. On the other hand, differences in the solutions of this study indicate that between-person traits are expressed in terms of different patterns of functions than are within-person states.

The patterns of factor loadings in the solutions for the T and S matrices are highly similar, as can be seen by inspection and as is suggested by congruence coefficients of .96, .99, .94 and .99 for factors I, II, III and IV, respectively. Also, although the factors in these analyses are broader and more co-operative than in some previous studies, the patterns are clearly those representing functions which have been identified in earlier investigations and there interpreted as indicating fluid intelligence (Gf), crystallised intelligence (Gc), broad visualisation (Gv) and broad fluency (F), respectively.

The Gf factor is well marked by span of apprehension (Ms), reasoning with figural materials (CFR), inductive reasoning with symbolic elements (I), reasoning with semantic fundamentals (CMR) and flexibility in making Gestalt closures (Cf)—all primary abilities which have defined the Gf factor in previous studies (Horn, 1968, 1970, 1971, 1972; Horn and Bramble, 1967; Horn and Cattell, 1966a; Rossman and Horn, 1972; Shucard and Horn, 1972). The thinking processes represented by these tasks are well-described as involving the perception of relations and the eduction of correlates in reasoning in the immediate testing situation. Since the salients defining Gf in this study are the primaries which defined the factor identified as Gf in studies preceding this one, the more detailed discussions of process in previous studies can be taken as applicable to the results from this study.

Similarly, Gc is defined by primaries which have defined it in previous studies—primaries such as verbal comprehension (V), analogical reasoning with semantic materials (CMR), convergence upon remote associations (O) and, to a lesser extent, ideational and associative fluency (Fa and Fi). Here, then, is a pattern which indicates concept attainments and reasoning that reflect use of some of the more esoteric elements of the collective intelligence of the culture. Thus, the processes indicated in this factor are also those of perception of relations and eduction of correlates, as in Gf; but here, as in previous studies in which Gf and Gc have been distinguished, the function is seen to depend upon esoteric knowledge. In O, particularly, the wider a person's experience, the more likely he can derive a correlate to represent a relationship among three concepts sampled from a wide range of concepts.

In factor III the broad visualisation function is revealed in prominent correlations with primaries requiring visual tracking (Vz), aiming (Ai), quick and accurate scanning to locate symbols (P) and flexibility in making Gestalt closures (Cf). The function represented by these variables would appear to be one of imagining change in space, finding a Gestalt and maintaining flexibility concerning various possible structurings of elements in space, processes that are described in somewhat more detail in the previous studies mentioned above.

The broad fluency dimension is well marked by major loadings on associative fluency (Fa), ideational fluency (Fi) and fluency in providing irrelevant responses (Fr), and lesser loadings in verbal comprehension and semantic reasoning.

The sizable off-diagonal congruence coefficients indicating noteworthy relationships for T-factor I with S-factor II and T-factor III with S-factor I do not detract from the finding that corresponding factors are well matched across the T and S analyses. These off-diagonal congruencies do indicate, however, that the Gf, Gc and Gv patterns, although clearly distinct, are, nevertheless, co-operative and correlated. In previous studies Gf and Gc have correlated between .5 and .6 and in the Horn and Bramble (1967) and Horn and Cattell (1966a) studies of Gf and Gv were found to correlate in this same range. Here the congruence coefficients reveal roughly this same degree of noteworthy intercorrelation among factors.

Thus, the results from factoring the T and S matrices indicate highly similar patterns that replicate previous findings. It will be recalled that the mathematical and metatheoretical analyses mentioned previously suggested that if traits were the primary determiners of variance in a set of variables, then the factorings of T and S should yield highly similar results. More specifically, it was suggested that the analyses on T and S should yield factors that are related by a diagonal matrix of proportionality, the elements of this matrix indicating the increase in reliability of the T-factors as a function of adding over the scores obtained on separate occasions. It can be seen in Tables 2 and 3 that these conditions obtain fairly well for the data in hand. The congruence coefficient for factors II and IV (Gc and F) are .99, very nearly unity, and congruences for Gf and Gv are also quite large (.96 and .94, respectively). The reliability proportionalities can be estimated to be approximately .73, .74, .62 and .71 for factors I, II, III and IV, respectively, these being the ratios of the variance contribution of a factor of S to the variance contribution of a corresponding factor of T. Expressed the other way around, as for use in equation (8) to indicate the increase in reliability achieved by making the variables 10 times as long, these proportionalities are 1.37, 1.35, 1.62, 1.40. More generally it can be noted that whereas the factors of T account for 73 per cent of the total variance, the factors of S account for only 51 per cent of the total variance, the ratio of the two overall variance contributions being 1.43.

As pointed out in the section on methodological rationale, if attributes are mainly state-like, the T matrix will approximate an identity matrix and the S matrix will have non-zero off-diagonal elements indicating the extent of common variation of the several variables defining the states and the factors of S will have larger variance contributions than the factors of T. Clearly, this is not the case here: the factors of T account for more variance than the factors of S. Insofar as states are not the sole source of variance, and the patterns of covariation on each given occasion are similar to the patterns of covariation among scores totalled over all occasions, the patterns of covariability observed on each given occasion can be taken to be indicative of traits. The evidence of the present study is thus clearly in support of an hypothesis stipulating that the broad ability functions of this study represent stable traits—at least stable over the time span and range of measurement conditions here considered.

The major implication of these results is to suggest that very little reliable state (function fluctuation) variance is represented in the variables of this study. Gc and Gf particularly, but F and Gv also, are apparently stable traits that fluctuate very little within a day and over successive days.

That the common variance of four factors in $W^{-1}T$ is less than the similar common variance in T is consistent with an hypothesis that T represents both trait and state variance, while $W^{-1}T$ represents trait variance alone. The mathematical and metatheoretical analyses discussed earlier suggested that over relatively few occasions the factors of T would be confounded to some extent by continuance of state and that a purer indication of traits would be the discriminant factors calculated on $W^{-1}T$. It can be seen in Tables 2 and 3 that these factors, also, are clearly matched with the factors of T and S , but that the congruencies in this case are lower: for Gf , Gc , Gv and F , respectively, these are .95, .74, .86 and .94 in the comparisons for the T and $W^{-1}T$ analyses, and .86, .73, .92 and .93 in the comparisons for the S and $W^{-1}T$ analyses.

It if be accepted that the factors of $W^{-1}T$ are the purest indicators of traits, then the trait of Gf is best revealed by CFR , D , Ms , Cf , I and CMR (in that order of magnitude of relation to the factor); the Gc trait is best indicated by O , V , Fr and CMR ; Gv trait is best defined by P , Vz and Ai ; and the trait of fluency is best measured by Fr , Fa and Fi . Although essentially the same variables appear as salients in these pure trait representations as appear in corresponding factors of T and S , the factors of $W^{-1}T$ are narrower and less co-operative. In this sense they are purer. Moreover, these analyses suggest that there is reliable variance that is not due to traits and therefore could represent state patterns or patterns of function fluctuation.

Turning now to a consideration of the analyses designed to reveal states and function fluctuations, it can be seen that the factors of W are not closely similar to corresponding factors of the other solutions. It should be noted that the factors of W involve very few variables with substantial loadings. All of the factors of W account for less than 20 per cent of the total variance and none of the individual factors accounts for more than 6 per cent of the total variance. Thus, these factors are very narrow in the sense that they involve few variables and even the salients have small correlations with the factor. Indeed, factor I can hardly be called a common-factor, since it involves only one variable with a loading larger than .15. But factor II is over-determined by correlations of .34, .20 and .19 with O , CFR and CMR , respectively. The first and last of these loadings are markers for Gc and CFR is a marker for Gf . The factor thus might best be related to G , the factor common to Gf and Gc , although it relates a bit more to the latter than to the former, as is indicated by the congruence coefficients for the comparisons with the results from analyses of T , $W^{-1}T$ and S . In any case the factor represents a function fluctuation that cuts across Gc and Gf . More mundanely, it indicates that the functions of intelligence which show the most reliable pattern of within-day and day-to-day fluctuations are those represented by the convergent reasoning of O , the figural reasoning of CFR and the analogic reasoning of CMR .

Factor III is clearly similar to, although narrower than, the GV factors revealed in the analysis for traits and in previous studies. It represents function fluctuation in the abilities of visualising. This fluctuation is manifested in the rather demanding tasks of visual tracking (Vz) and Gestalt closure (Cf). Thus, there is indication that state variability in the broad visualisation function is shown most clearly when tasks require one to imagine changes in space and to follow change in a spatial pattern. These processes are to be contrasted with what might be

characterised as focusing on, or fixing on, a particular pattern as is required in both P and Ai. In contrast the Cf and Vz tasks require that one allow the eye to follow in and around the curves of a pattern.

Factor IV in the analyses of W can be matched with the broad fluency function identified in the other analyses. However, here Fr has a noteworthy *negative* correlation with the factor, whereas in all of the other analyses, Fr has a positive relationship to the broad fluency function. This indicates that the number of irrelevant associations (as judged by scorers) is *negatively* related to fluency in short period changes within persons, but is positively related to fluency when comparisons are made between persons. What this may mean is that: (1) the person who characteristically provides many associations to a stimulus concept tends also to give rather many irrelevant associations, but (2) now considering variability within persons, whenever an individual gives a relevant association, he is thereby not giving an irrelevant association so that as the number of one kind of association increases, the number of the other kind must decrease.

This finding is interesting not only because it provides some information about the general fluency function, but also because it illustrates something about the research strategy employed in this study. The reversal finding could not have been discovered by R-technique analyses alone; if the negative association were found in a P-technique analysis which followed several R-technique studies (as would normally be the case), then it could very well be misinterpreted as an anomalous lack of replication of previous results. But in the present study the correlations having opposite signs are clearly shown to exist in the same data, so the negative correlation cannot be interpreted as merely an anomaly resulting from drawing a rather odd (one person) sample. When seen in this way the opposite-sign relationships provide useful information about the nature of the concepts under investigation.

In terms of the hypotheses presented earlier, these results suggest that the *trait* of general fluency depends to some extent upon the size of the store of concepts in memory, as represented by CMR. As suggested by interpretations of this factor in previous studies, however, trait F apparently does not depend upon the clarity of perception of differences among concepts; indeed, O, representing this function, has a negative relationship to F in all but the W analysis, and this relationship is substantial in the analysis of $W^{-1}T$. The function fluctuation pattern of F, on the other hand, does not involve CMR or O but has a slight correlation with immediate memory. This suggests that function fluctuation on this factor involves speed of transmission from long term memory to expression modalities.

Now considering the relative contributions of state and trait to the observed variability of the four intellectual functions, we may notice first that in the W analysis to reveal states, general fluency and general visualisation have the larger common variances and factors I and II the smaller ones. This is noteworthy because the reverse of this ordering for common variance contribution exists for the factors determined on the total scores of T. These findings suggest that although Gv and F are mainly trait-like, they involve relatively more function fluctuation (relative to the total variability in these kinds of performances) than do Gf and Gc.

The fact that the common variance defined by four factors is smallest for W indicates that much of the variation *within* a person in performances on ability tasks is unsystematic—i.e., error. This is not an unexpected finding, of

course. Indeed, it would seem that in much previous research on (and discussion of) abilities it has been assumed, albeit implicitly, that all variation within the person is random. That this assumption is not warranted is indicated in the present results by the fact that interpretable patterns are found in analyses on *W*: indeed, two of these relate to trait patterns. These factors are too consistently in line with other findings to make it reasonable to suppose that they represent only random variance.

SUMMARY

A general theoretical rationale for identifying different kinds of traits, states and function fluctuations in traits was outlined. This provided a basis for developing a set of mathematical procedures which would allow for some separation of traits and states, both seen as patterns of distinct but covarying processes. A substantive theory about fluid intelligence (*Gf*), crystallised intelligence (*Gc*), broad visualisation (*Gv*) and broad fluency (*F*), provided an opportunity to study the metatheory and methods of analysis while also considering the hypothesis that intellectual abilities fluctuate in a reliable manner over periods as short as a few hours and days.

Measurements of 14 primary mental abilities were obtained on 10 separate occasions for 106 male adult inmates of a state penitentiary. All correlations among the 14 primaries were determined within each session considered separately and the resulting matrices were pooled over the 10 sessions to provide a matrix labelled *S*. Within each subject considered separately a 14 by 14 matrix of correlations among the primaries and over occasions was formed and the resulting 106 matrices pooled to provide a matrix designated *W*. The primary factor measurements for each session considered separately were converted to standard score form and the resulting score matrices were summed over the 10 occasions to provide a total score, over all sessions, for each subject on each primary. A 14 by 14 matrix of intercorrelations for these total primary factor scores was obtained. This was symbolised *T*.

The *S*, *W* and *T* matrices resulting from the above-mentioned analyses were factored using an iterative principal axes procedure. A rationale and method was developed for maximising trait variability relative to state covariability among a set of variables. The method involved using special procedures to factor $W^{-1}T$. Four common factors were estimated in all analyses. The initial factors from all solutions were rotated orthogonally in accordance with the Varimax criteria. The resulting factors solutions were examined in some detail to see what evidence they provided about the statelike and static, trait-like characteristics of broad attributes of intellectual functioning.

The four rotated factors found in the analyses for traits and traits confounded with states were found to be representative of four major dimensions of intellect found in previous research, (*Gf*), (*Gc*), (*Gv*), and (*F*). The *Gv* and *F* patterns were also fairly clearly identified in the analysis for dynamic states although their variance contributions in these analyses were considerably smaller than in the analyses for traits. Function fluctuations of *Gf* and *Gc* were not clearly separated. Instead a pattern which cut across both of these intellectual functions was found in the analyses to reveal reliable within-person changes. The results represented by this factor suggest that short period fluctuations in general intelligence show up most consistently in convergent semantic reasoning, analogic semantic reasoning and figural reasoning—perhaps reasoning in general. The dynamic variability in general visualisation was found to be more closely associated with primaries requiring roving eye movements and imagination of

things not seen than with primaries requiring focusing on particular, pre-defined patterns.

Within the person, change in ideational fluency was most closely associated with change in associational fluency but change in the direction of producing somewhat irrelevant associations had a substantial negative relationship in this pattern. In the analyses for traits (between-persons), irrelevant associations had substantial *positive* correlation with the general fluency dimension. The major variance contribution on all factors was from trait influences. Reliable, common state variability was relatively more pronounced in Gv and F than in intelligence.

Perhaps the principal value of this study is to be found in the research strategy adopted. This was directed at defining functional unities in terms of several conceptions about what might constitute a 'unity' and what is meant by 'functional.' The results illustrated how abilities vary functionally within persons and also represent stable patterns of performances that distinguish one person from another despite fluctuation. This kind of finding is of theoretical interest and may have some practical applications.⁶

FOOTNOTES

¹ I am indebted to Ledyard Tucker, William Roseboom, Kellogg Wilson and Harold Bartlett for comments and criticisms which very materially affected my thinking and calculations in this study.

² For help in construction of tests and analyses, I thank Dr. William Bramble. I am also grateful to John Knapp for his expert help with the analyses.

³ The gathering of these data was possible only because I received help and co-operation from many people. Mr. Harry Tinsley, Director of Institutions for Colorado, and Warden Wayne K. Patterson provided general approval for the data gathering at the prison. Mr. George Levy was instrumental in arranging for this approval; he also provided supervision in the administration and scoring of tests and in numerous other ways contributed to completion of the project. To all of these people and to others too numerous to list, I am happy to extend my sincere thanks.

⁴ I am particularly grateful to Mr. Harold Bartlett for valuable help in translating these equations from the programme provided by Cooley and Lohnes.

⁵ For supplementary material, order Document NAPS 01765, from ASIS National Auxiliary Publications Service, c/o CCM Information Corporation, 866 Third Avenue, New York, New York 10022, remitting \$3 for each microfiche or \$5 for each photo copy.

⁶ This study was supported in part by a NASA Grant in Space-Related Sciences, No. G-518, DRI-614 and in part by a Research Career Development Grant 5-K3-AD-10, 651.

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RESEARCH NOTES

IDENTITY, LANGUAGE-ACTIVATION TRAINING AND CONSERVATION

By B. REMMO HAMEL, M. A. A. VAN DER VEER AND RENIE WESTERHOF
(*Department of Developmental and Clinical Child Psychology, (Free University,
Amsterdam)*)

SUMMARY. The relation between (non-) conservation responses and the reasons given for these reactions was investigated among 80 6-year-old children. It was found that partial conservers gave perceptual reasons for their non-conservation responses and identity arguments for their conservation reactions. Language-activation training promoted both the acquisition of the conservation response and the giving of an adequate reason for this response by those children who were partial conservers and already on the border line of conservation. The role played by the identity concept in conservation-acquisition was stressed in interpreting these results.

INTRODUCTION

The conflicting conceptions of Piaget and Bruner with regard to the role the identity concept plays in the process of conservation acquisition, result from their differing views on what criteria define conservation and also on what processes are essential to it.

With conservation experiments Bruner's (1966) conservation criterion simply lies in the response the child gives to the question about equivalence: i.e., with conservation of liquids: "Is there just as much, more or not as much water as here?" In order to gain insight into the psychological process of conservation-acquisition, Bruner takes the reasons given in support of non-conservation and conservation into account. His findings are that non-conservers give mainly perceptual reasons for their judgments and conservers give mainly identity reasons (i.e., it is the *same* water) for their judgments. Therefore, Bruner states that a recognition of identity is a necessary if not a sufficient condition for conservation. This hypothesis gained some support in a previous experiment (Hamel, 1971).

With regard to the process of conservation-acquisition Piaget (1952) maintains that reversible operations (reversibility by inversion or reversibility by reciprocity) are of crucial significance. Therefore, Piaget regards a child as a conserver only when he supports his conservation reaction with a reason which shows that he is capable of reversible operations (i.e., compensation reasons).

The first aim of our experiment is to explore whether the developmental change from non-conservation to conservation is connected with a change in the nature of the reasons given by the child for his (non)-conservation reaction. In line with Bruner we state the following hypotheses:

- (1) Non-conservers give more perceptual reasons than identity or compensation reasons for their judgments;
- (2) Conservers give more identity reasons than perceptual reasons.
If the above-mentioned connection exists, then we would expect the reasons partial-conservers give for conservation to differ from the reasons they give for non-conservation. Therefore, we state:
- (3) Partial-conservers give mainly perceptual reasons in non-conservation reactions and mainly identity reasons in conservation reactions.

Bruner considers intellectual growth to be the result of a conflict which arises when an event is represented in more than one way. With a conservation task such a conflict may arise when the child perceives that the outward appearance of an object changes but is also able to put into words a judgment of identity. According

to Bruner, such a conflict can be induced between the ikonic mode (the appearance of something) and the symbolic mode (its description in language) by activating the linguistic experiences of the child. The language-activation would decrease the dependence of the child's behaviour on information in the perceptual field and increase the probability of utilising conceptual processes.

On the basis of Bruner's views one can predict that conservers can describe the stimulus situation more adequately in language than non-conservers. Inhelder *et al* (1966) and Sinclair (1967) point out that conservers are superior to non-conservers in their use of the relational terms 'more,' 'less' and 'same.' This suggests the possibilities that the acquisition of conservation makes possible the correct use of the relational terms or that training in the use of these concepts may lead to conservation—acquisition.

With regard to the latter inference Piaget views language as insufficient to bring about the acquisition of the logical operations which are necessary for conservation. This view was supported by Sinclair (1967). Furthermore, Piaget stresses the multiplicity and variety of experiences the child needs in order to develop his cognitive structures. In short-term training procedures there is little opportunity for such richly varied experiencing. In this view, little effect would be expected from such training procedures.

The second aim of our experiment is to investigate whether language-activation training on the relational terms 'more,' 'less' and 'same' facilitates conservation-acquisition. We state the following hypotheses:

- (4) Conservers perform better than non-conservers on a relational terms test;
- (5) Language-activation training promotes conservation-reactions.

METHOD

Subjects. 80 subjects, four groups of 10 boys and 10 girls each from middle-class junior schools, were tested. Their IQ was measured by the Pintner-Cunningham Test. In Group I there were 20 conservers (mean age 74.3 months, σ 2.9; mean IQ 123.7, σ 10.7). In Group II there were 20 partial-conservers (mean age 75.6 months, σ 2.6; mean IQ 114.9, σ 12.6). In Group III there were 20 non-conservers (mean age 73.7 months, σ 3.0; mean IQ 118.3, σ 13.5); and in Group IV (control group) there were another 20 non-conservers (mean age 72.4, σ 3.7; mean IQ 117.3, σ 6.6). There were no significant differences within and between the groups with regard to age, IQ and sex. Since no sex influences were found in the results, the data of each group were treated as a whole.

Conservation Pretests. In the first pretest each child was given two identical cylindrical glass beakers (A_1 and A_2) which contained the same quantity of liquid. The experimenter then poured the water from A_1 into a narrower and taller glass beaker (B) and asked the child, "Is there (pointing to B) just the same amount, more, or less water as here (pointing to A_1)?" After he answered the child was asked to explain his response.

In the second pretest each child was again given A_1 and A_2 which each contained the same quantity of liquid. The content of A_1 was then poured into six smaller identical glass beakers and the child was asked the same questions as he was asked in the first pretest. To avoid response-sets to the alternatives, *more*, *less* and *same*, the sequence of these was varied.

Bruner's procedure was used (Bruner *et al.*, 1966, p. 188) to determine which children were conservers, non-conservers, and partial conservers. Subjects who passed both pretests were considered conservers, and subjects who passed only one of the pretests were regarded partial-conservers. Those who failed on both pretests were considered non-conservers. The reasons given by the subjects were divided into the following three categories:

Perceptual. Reasons which referred to the shape or form of the glass beakers or to its dimensions, e.g., "There is more water because this glass is thinner."

Identity. Reasons which referred to the identity of the water, e.g., "It is the same water."

Compensation. Reasons that implied the logical multiplication of height and breadth, e.g., "The water rises because that glass is taller and narrower."

Only the correct judgments given on the pretests, and *not* the subjects' reasons, were considered as criteria for conservation.

Relational terms pretest. Within two weeks of the administration of the pretests a pictorial test was given to groups I, II and III, consisting of four items of discontinuous quantity and nine items of continuous quantity. Each discontinuous item consisted of three groups of different kinds and numbers of discrete objects (flowers, birds, etc.). In each item the experimenter pointed to one of the groups of objects and asked the subject to point to a group in which there were more, less or the same. Each continuous item consisted of pictures of four glass beakers with water. Some of them were equal in breadth but varied in water level and others were equal in water level but varied in breadth. In each item the experimenter pointed to a glass of water and asked the subject to point out the glass which contained more, less or the same amount of water. Since the subject replied to three questions in each of the 13 items, 39 responses were obtained from each subject.

Relational terms training. Immediately after the pretests the subjects in group II and III were asked the same questions as in the pre-tests, but now the experimenter corrected faulty answers by focusing the attention of the subject on the similarities and differences in height and breadth of the water and the glass beakers. This was done to teach the subject to abstract the relevant attributes of the concepts 'more,' 'less' and 'same' from the stimulus field. For example, the experimenter asked each subject, "Which glass is just as wide as that glass? Is the water at the same height in these glasses? The water is at the same height and the glasses are of the same width. Therefore, the glasses have the same amount of water." The control group (group IV) received no training.

Relational terms post-test. After the relational terms training groups II and III were post-tested with the relational terms pretest.

Conservation post-tests. After the relational terms pretest, training and post tests, groups II, III and IV were given the conservation post-tests which were identical with the conservation pretests.

RESULTS

Conservation pretests. The results of the conservation pretests are presented in Tables 1 and 2. Non-conservers gave almost exclusively perceptual reasons whereas conservers gave more identity and compensation reasons than perceptual reasons (pretest one: $\chi^2 47.76$, df 4, $P < .001$; pretest two: $\chi^2 25.81$, df 4, $P < .001$; I-test Spitz, 1965). The results support hypotheses one and two.

TABLE 1

NUMBER OF REASONS GIVEN BY CHILDREN FROM DIFFERENT GROUPS IN SUPPORT OF JUDGMENTS OF CONSERVATION AND NON-CONSERVATION ON CONSERVATION PRETESTS 1 AND 2.

Reasons	Pretest 1			Pretest 2		
	C	PC	NC	C	PC	NC
Perceptual..	3	16	20	6	4	16
Identity....	6	4	—	9	13	1
Compensation	11	—	—	3	1	—
Rest	—	—	—	2	2	3
No. of Reasons	20	20	20	20	20	20

C—Conserver; PC—Partial-conserver; NC—Non-conserver.

As shown in Table 2, partial-conservers gave primarily perceptual reasons in support of their non-conservation responses, and identity reasons in support of their conservation-responses (pretest one: $\chi^2 15.01$, df 2, $P < .01$; pretest two: $\chi^2 9.89$, df 3, $P < .025$; 1-test Spitz, 1965). This confirms hypothesis three.

TABLE 2

NUMBER OF REASONS GIVEN BY PARTIAL-CONSERVERS IN SUPPORT OF THEIR JUDGMENTS OF CONSERVATION OR NON-CONSERVATION ON CONSERVATION PRETESTS 1 AND 2.

Reasons	Pretest 1		Pretest 2	
	Cons. resp.	Non-cons. resp.	Cons. resp.	Non-cons. resp.
Perceptual	1	15	2	2
Identity	4	—	12	1
Compensation	—	—	1	—
Rest	—	—	—	2
No. of reasons	5	15	15	5

Relational terms pretest. A 3×2 analysis of variance showed:

(1) differences between the groups on their total error-scores on the relational terms test were significant ($M_I = 11.03$; $M_{II} = 18.08$; $M_{III} = 24.63$);

(2) M_I and M_{III} differed significantly ($P < .02$; Duncan's new multiple range test, Edwards, 1960);

and (3) differences between error-scores on discontinuous and continuous materials were significant, and the error-scores on discontinuous materials were significantly less than the error-scores on continuous materials in groups II and III (Group I: $t = 0.89$, df 19, NS; Group II: $t = 1.84$, df 19, $P < .05$; Group III: $t = 4.48$, df 19, $P < .005$ —one-tailed tests). There was also a significant interaction effect between groups and type of material.

TABLE 3

ANALYSIS OF VARIANCE OF THREE GROUPS ON THE RELATIONAL TERMS PRETEST.

Source	Sum of Squares	df	Mean square	F	P
Group I, II, III	3700.87	2	1850.43	11.91	.01
Type of material	2058.41	1	2058.41	18.29	.01
Interaction	932.86	2	466.43	4.15	.05
Error (a)	8851.63	57	155.29	—	—
Error (b)	6414.52	57	112.53	—	—
Total	21958.29	119	—	—	—

(a) non-repeated measurements; (b) repeated measurements.

Relational terms post-test. As shown in Table 4 subjects made fewer errors on the relational terms post-test than they did on the pretest.

TABLE 4

PERCENTAGE OF ERRORS ON CONTINUOUS MATERIALS OF THE RELATIONAL PRE- AND POST-TESTS.

	Partial-conservers	Non-conservers
Pretest	21.10	32.60
Post-test	1.55	5.90

Conservation post-tests. Fifteen partial conservers gave conservation responses on both conservation post-tests ($x = 0$, $N 15$, $P < .001$; sign test, Siegel, 1956) and four non-conservers also gave conservation responses on both post-tests; two non-conservers gave a conservation response on one of the post-tests and only one of the control-group subjects gave a conservation response on the post-tests ($\chi^2 = 0.94$, $df 1$, NS). As shown in Table 5 there were also significant changes in the arguments or reasons given by partial conservers ($\chi^2 8.98$, $df 2$, $P < .025$; 1-test Spitz, 1965).

TABLE 5

CHANGES IN REASONS GIVEN BY 15 PARTIAL-CONSERVERS WHO LEARNED TO CONSERVE ON THE POST-TESTS.

		Post-test	
		Identity	Compensation
Pretest	Perceptual ..	10	4
	Identity	0	1

Where they had previously given perceptual reasons, they now gave identity or compensation reasons.

DISCUSSION

Our hypothesis that non-conservers would give more perceptual than identity arguments, and that conservers would give more identity than perceptual reasons for their judgments was supported by the conservation pretest results. It was striking that partial conservers gave perceptual arguments for their non-conservation responses and identity reasons in support of their conservation responses. The few conservers who gave compensation arguments for their judgments met Piaget's conservation criterion since their verbal justification showed that they possessed the logical operations necessary for conservation. Results from the majority of subjects supported Bruner's view that conservation is supported by the recognition of identity. Since Bruner's criterion for conservation was used, the conservation acquisition process in this study can probably best be interpreted by viewing it as three-stage process. In the non-conservation stage the child depends in his judgments on the perceptual aspects of the stimulus situation. Changes in appearance of the stimulus force the child to modify his judgment. In the second stage the child sometimes gives conservation reactions. His judgments are supported by identity reasons. Now the child learns to handle the identity 'concept.'

In our opinion, this is a relatively primitive concept because it can be directly gathered from the perceived stimulus situation: the water stays the *same* water in spite of the changes in appearance of some of its dimensions. But these dimensions

are not taken into account, let alone the relations between them. At this stage Bruner considers the child to be a conserver, while Piaget would call him a pseudo-conserver. This identity 'concept' forms a basis for the achievement of the conservation stage. In this stage the child always gives conservation reactions. He now can grasp the dimensions of the glass beaker and co-ordinates the relations between them. Compensation reasons are now given to support his judgments. At this point the child is regarded as a conserver by Piaget. At any rate it seems useful to distinguish between conservation reaction and conservation concept. The latter does not enter the discussion until a theoretical analysis of the child's response is made.

The results on the relational terms pretest confirm the finding of Inhelder *et al.* (1966) and Sinclair (1967) with regard to the use of relational terms. The results also indicate that the use of relational terms is more difficult with continuous materials than with discontinuous ones. This agrees with the findings of Piaget (1952) and Smedslund (1961) that conservation of discontinuous material is achieved before conservation of continuous material.

Our hypothesis that language-activation training would promote conservation reactions was confirmed only for the partial-conservers and *not* confirmed for non-conservers, who appeared not to benefit appreciably from the short training procedure used in the study. Our training procedure was aimed at improving the language which non-conservers and partial conservers use to describe the stimulus situation of the conservation problem. For this reason, during training the child's attention was directed to the relevant stimulus dimensions of the conservation problem (i.e., water level and width of the glass), and a verbal rule was given for the use of the relational term 'same.'

In principle it is possible to investigate each aspect of the complex training procedure separately, and this would obviously facilitate the interpretation of results. We purposely chose a more complex procedure since this is more comparable to the instruction methods used in the elementary school.

The finding that this training procedure, in which the identity concept was not touched on, led partial conservers especially to give conservation reactions supported by identity arguments, means some support for Bruner's view that a recognition of identity (the conviction that the water remains the same in spite of changes in outward appearance) is a condition for conservation.

ACKNOWLEDGMENT—We wish to thank Professor Dr. J. de Wit, Han Groenendaal and Nick den Hartog for their critical comments on earlier versions of this article.

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Author's address: Drs. B. REMMO HAMEL, Paedologisch Instituut, Vrije Universiteit te Amsterdam, Vossiusstraat 56, Amsterdam, The Netherlands.

(Manuscript received 15th October, 1971)

CONSERVATION OF SUBSTANCE IN THE BLIND AND PARTIALLY SIGHTED

By M. J. TOBIN

(Research Centre for the Education of the Visually Handicapped, University of Birmingham)

SUMMARY. Previous investigations of the effects of visual impairment on the development of perceptual and cognitive skills are discussed and related to the practice of making separate educational provision for the visually handicapped. The alleged developmental lag is examined from a different viewpoint, and, on the basis of a conservation of substance experiment with 189 blind and partially-sighted children, it is inferred that while the best of them are performing on a par with the best of their sighted peers, the age range in which conservation is attained is more extended for the visually handicapped. It is suggested that Piagetian-type tasks may be of direct practical use to teachers for diagnostic and teaching purposes.

INTRODUCTION

The segregation of visually handicapped children, which is characteristic of the British—but not so much of the American—system of education rests upon a number of suppositions. One of these is that, as Wills (1965) puts it, the child "lacking a major sense such as vision would understand his world later and in a different way from a child with full sensory equipment." There are, of course, other reasons for this segregation, such as the assumption that it is more efficient to house the specialist equipment and staff in one place.

If the supposition that Wills refers to is well-founded, then the 'later' understanding of his world by the visually handicapped child may be brought forward or accelerated by the special and systematic techniques that can be deployed in a segregated system. Some support for a kind of developmental lag may be found scattered through the rather sparse literature reporting research in this area. Gomulicki (1961), for example, in an investigation of the development of perception in the blind found 5-year-old blind children to be significantly inferior over a wide range of tactual and auditory perceptual skills as compared with a group of sighted peers. By the age of 10, the blind had largely caught up and Gomulicki inferred that the absence of the integrative function of vision served to make "the task of developing effective use of the other senses a particularly difficult one." Similar findings are reported by Menaker (1966) who compared blind and sighted subjects on tasks involving the tactile-kinaesthetic sense. The improvement with age on a size-weight task was more rapid among the sighted. In a dissertation not seen by the author, Hartlage (1967) is reported to have compared the performance of sighted children and children blind from birth on concepts of a spatial and a non-spatial nature. The blind were inferior to the sighted at all ages on the spatial questions but were operating at a similar level on the non-spatial items. In the USSR, Zemtsova and Solntseva (Solntseva, 1966) demonstrated that at the pre-school period "there persists for a very prolonged time . . . a marked generalisation, and global, poorly differentiated recognition" of ordinary household objects, the blind child tending to label objects by their class rather than specifically. Difficulty was also found in recognition of small-scale models of familiar objects and the Russian investigators inferred that this was due to the "complexity and difficulty of formation . . . of constant images, perceptions, and concepts."

Although some studies (e.g., Hunter, 1954) have reported superiority for the blind on some tactual perception tasks involving tactual recognition of geometric shapes and judgments of 'straightness,' the overall weight of what little evidence there is would seem to suggest that severe visual handicap is associated with greater difficulty or expenditure of time in attaining comparability with the sighted in some perceptual and cognitive skills. Further support for this interpretation may be found in the investigations carried out by Tillman (1967) and Zweibelson and Barg

(1967). The former compared 110 blind and 110 sighted children in the WISC and summed up his findings as showing, for the blind, "a lack of integration among educational experiences" with each bit of knowledge being "isolated and cast into a separate frame of reference." Verbal abilities were seen as focusing on a "basic vocabulary without much elaboration," with the blind tending "to approach abstract conceptualisation problems from a concrete and functional level" and, therefore, lagging behind their sighted peers. In their small-scale investigation using the similarities and vocabulary sub-tests of the WISC, Zweibelson and Barg also found significant differences, with the blind children operating at a more concrete, functional level of conceptualisation.

In some of these studies, the investigators have drawn attention to the fact that the best of the blind children were performing as well as the best among the sighted. The inference is that visual handicap is not, *per se*, the cause of any observed, overall retardation of development. In the light of their examination of some 295 blind pre-school children in the United States, Norris, Spaulding and Brodie (1957) went so far as to say that the "child who has had favourable opportunities for learning before nursery school age is able to take his place in a regular nursery school programme with sighted children." In the absence of any means of ensuring that these 'favourable opportunities' are available for all blind children, the school is left with the twin tasks of identifying the under-privileged when they arrive and providing the appropriate compensatory stimulation. For the teacher, Piaget's approach to the investigation of cognitive development has the advantage of being, at least potentially, both diagnostic and educative; as Lovell and Ogilvie (1960) have put it, Piaget's "experiments are in themselves learning situations." In the investigation reported here, which is part of a series of replications with visually impaired subjects of the classical Piagetian conservation experiments, the aim was to explore the problem of the suggested developmental lag of the visually handicapped child from a different standpoint and to evaluate Piagetian-type tasks as simple diagnostic tools for use by teachers of the visually handicapped. While the procedures detailed by Piaget (e.g., Piaget and Inhelder, 1941, p. 7) were to be followed in principle, some minor modifications similar to those used by Lovell and Ogilvie and Elkind (1961) were adopted and are described below.

METHOD

Subjects.

189 children registered as blind or partially-sighted participated in this part of the study. They were drawn from two schools, one a residential school for the blind and the other a day school for the partially-sighted, neither of which took in children with gross, additional sensory handicaps. Both were 'all-age' schools, with an age-range of 5-17 years. At the primary school level, the children would represent the full ability range but at the secondary level there would be a curtailment of the IQ distribution as a result of operation of grammar school selection procedures. As categorisation of a child as visually handicapped depends upon an ophthalmologist's evaluation of measurable visual acuity and field of vision, a 'blind' child may be one who is totally and unquestionably without vision, as in the case of bi-lateral retinoblastoma involving excision of both eyes; at the other end of what is a continuum of visual defect, the child may be one who has moderate acuity but a very restricted visual field. When the partially-sighted are included, this continuum is extended considerably. For the purposes of this study, the subjects were assigned to one of three groups. Group 1 were those who could count the investigator's fingers, the subjects being allowed to move their position and distance to obtain the best optical conditions. Group 2 consisted of those who had 'object perception' or could see a moving hand at the position and distance most convenient to them. Group 3 comprised the totally blind and those with 'light perception,' i.e., those who could tell they were facing a window in daylight conditions or could visually recognise when the electric light was switched on and off. No selection of subjects was made; all those in the age range 5.0 to 15.11 inclusive, were tested.

Apparatus.

Five balls of plasticine were made. All were different in colour, and all very clearly different in size except for two which were made from similar quantities of plasticine. To maintain a similar feel and consistency, the balls were immersed in warm water between testing sessions.

Procedure.

Each subject was tested individually, the interview being tape-recorded, and each was asked to feel the five balls of plasticine on the tray in front of him. It was made clear that two of the balls had been made from the same amounts of plasticine, and the subject's first task was to find these two balls. Once this had been done, the experimenter removed the other three balls while the subject held the two that were alike. He was then asked to give the experimenter one of the two balls and was again questioned as to whether the experimenter had the same amount of plasticine as himself. If there was any doubt in his mind, he was told he could do whatever he wished to make the two balls alike. Four further questions were then asked:

- (1) *Prediction.* "If we roll my ball into a shape like a sausage by pressing down on it, will there be as much plasticine in my sausage as in your ball?"
(Experimenter and subject together then rolled this ball into a sausage.)
- (2) *Judgment.* "Is there as much plasticine in my sausage as in your ball?"
- (3) *Explanation.* "Why do you say that? Can you give me a reason?"
- (4) *Reversibility.* "What would happen if we rolled my sausage into a ball? Would there be as much plasticine in my ball as in yours?"

If a 'Yes' had been given to questions (1) and (2), and a satisfactory explanation given in response to question (3), the interview was closed after question (4). If anything other than a set of three correct responses was given, the procedure was repeated, but the questions and deformations were in respect of the ball held by the subject. If the same pattern of answers emerged, the interview was closed. If the pattern changed, the procedure was repeated for the last time, with the experimenter's ball again being the object to be deformed. Question 4, suitably changed, followed in each case.

Scoring.

Each subject's last set of responses was used for deriving a conservation score. Two methods of classification were used. Method 1 involved using questions (1) to (3), inclusive, with each conservation response being scored 1 and each non-conservation response being scored 0; for each subject there was, therefore, a maximum conservation score of 3. In Method 2, the subject was classified as a conservor only if all three responses were correct; a less than perfect score entailed classification as a non-conservor.

RESULTS

Table 1 shows the percentage of conservation responses made at each age level by subjects in each category of visual impairment. For comparison, the appropriate section of the results obtained by Elkind with sighted subjects is included. The percentage of conservation responses made by Elkind's 7-year-olds was 70 per cent, a figure that steadily increased from then on. In the present study, the 70 per cent level was not reached until age 9.0—9.11.

Table 2 shows the analysis based on Method 2, with classification as 'conserving' being dependent upon correct answers being given to all three questions. This more stringent procedure results in the 70 per cent level not being reached until age 10.0—10.11, but the small numbers of subjects at each age level could easily account for such a change. No direct and clearly valid comparison can be made with other studies but Beard's (1963) investigation into conservation among sighted primary school children gave percentages of conservors in five age-groups. In the age-groups 4.10—5.9, 5.10—6.9, 6.10—7.9, 7.10—8.9, and 8.10 upwards, the percentages were 47 per cent, 63 per cent, 72 per cent, 70 per cent and 86 per cent, with the 70 per cent level being located, therefore, in the 6.10—7.9 group.

TABLE 1
PERCENTAGE OF CONSERVATION RESPONSES: METHOD 1.

Degree of vision	AGE LEVEL									
	5.0- 6.11	7.0- 7.11	8.0- 8.11	9.0- 9.11	10.0- 10.11	11.0- 11.11	12.0- 12.11	13.0- 13.11	14.0- 14.11	15.0- 15.11
Can count fingers, using vision	30 (18)	40 (21)	63 (18)	70 (18)	93 (9)	100 (9)	100 (4)	92 (13)	97 (11)	100 (15)
Can perceive objects or hand movements	0 (3)	50 (2)	67 (1)	100 (1)	44 (3)	— —	— —	— —	— —	100 (3)
Can perceive light, or totally blind	0 (6)	56 (6)	33 (3)	50 (2)	75 (4)	75 (4)	100 (3)	100 (5)	67 (3)	50 (4)
Total (N=189)	20 (27)	44 (29)	59 (22)	70 (21)	79 (16)	92 (13)	100 (7)	94 (18)	90 (14)	91 (22)
Elkind study, sighted sub- jects (N=25)	5-5.11 6-6.11 19 51	70	72	86	94	92	—	—	—	—

Number of subjects in parentheses. Maximum possible score per subject=3. E.g., in row 1, column 1, with N=18, there were 54 responses, of which 16 (30 per cent) were conservation responses.

TABLE 2
PERCENTAGE OF CONSERVERS: METHOD 2.

Degree of vision	AGE LEVEL									
	5.0- 6.11	7.0- 7.11	8.0- 8.11	9.0- 9.11	10.0- 10.11	11.0- 11.11	12.0- 12.11	13.0- 13.11	14.0- 14.11	15.0- 15.11
Can count fingers, using vision	11 (18)	29 (21)	61 (18)	61 (18)	89 (9)	100 (9)	100 (4)	92 (13)	91 (11)	100 (15)
Can perceive objects and/or hand move- ments	0 (3)	50 (2)	0 (1)	100 (1)	33 (3)	— —	— —	— —	— —	100 (3)
Can perceive light, or totally blind	0 (6)	50 (6)	33 (3)	50 (2)	75 (4)	75 (4)	100 (3)	100 (5)	67 (3)	50 (4)
Total (N=189)	7 (27)	34 (29)	55 (22)	62 (21)	75 (16)	92 (13)	100 (7)	94 (18)	86 (14)	91 (22)

Number of subjects in parentheses. E.g., in row 1, column 1, with N=18, there were 2 conservers (11 per cent).

In the Lovell and Ogilvie study the criteria for classification as non-conservers, transitional, and conserving are not made explicit and the age-groupings are rather different from those used in the present study. However, by allowing one conservation mark to each of their 'transitionals,' and three to each of their conservers, a set of percentages of conservation responses may be obtained for each of the four years of junior school (7 to 11+). They are: 69 per cent, 80 per cent, 88 per cent and 95 per cent. These may be compared with the percentages for the visually handicapped aged 7.0 to 11.11 (the two years 10.0 to 11.11 being combined), as derived from Table 1, viz, 44 per cent, 59 per cent, 70 per cent and 85 per cent. (Worth noting here is the close similarity between the Lovell and Ogilvie findings, based on sighted children in Great Britain, and the Elkind findings, based on sighted children in the United States. In both cases, the percentage of conservation responses at each level is higher than the corresponding figure obtained with the visually handicapped.)

Out of 58 non-conserving subjects who gave 'explanations' for their judgments, 42 gave explanations of a perceptual nature, centering on such features as length, height, fatness, thickness, roundness, and weight (two only). Seven said the sausage had most "Because we've rolled it out"; two gave this same reason in justification of their belief that the ball had most. Other explanations included references to colour (one only), strength, eating, and the experimenter's personality ("The ball has most because you're nice!"). Among the 117 subjects who were classified as conservers in Table 2, i.e., those who gave three correct responses, the explanations may be categorised as follows:

- (a) Plus/Minus (e.g., "None added or taken away,") 34 (29 per cent).
- (b) Reversibility (e.g., "They were the same before,") 61 (52 per cent).
- (c) Co-ordination of Relations (e.g., "The sausage is longer but thinner,") 9 (8 per cent).
- (d) Shape (e.g., "It has only been changed in shape,") 9 (8 per cent).
- (e) Identical Action (e.g., "The ball would be the same if rolled out,") 3 (3 per cent).
- (f) Weight (e.g., "It would still weigh the same,") 1 (1 per cent).

The youngest subject offering an explanation in categories (c) to (f) inclusive, was aged 7 years 10 months.

In labelling category (b) as 'Reversibility,' the practice adopted by Lovell and Ogilvie has been adopted. Another aspect of this problem was tackled by the use of Question (4) ("What would happen if we rolled my sausage into a ball? Would there be as much plasticine in my ball as in yours?"). All those conserving said that there would be the same amount of plasticine in both balls. Among the non-conservers, 30 out of 58 (52 per cent) said there would be the same amount in both balls, while 28 (48 per cent) said there would not. Analysis of the tape-recordings of the responses did not produce sufficient clarification on this issue and it is not possible, therefore, to say with certainty whether all the 52 per cent were demonstrating reversibility as opposed to making a correct 'guess.' Nevertheless, some of these subjects did justify their answer by referring to the initial equality and this would seem to indicate that reversibility may be a necessary but not a sufficient condition for attainment of conservation. The small numbers of subjects in some of the cells made it impossible to evaluate differences among the categories of degrees of residual vision.

DISCUSSION

The increase in conservation responses with age that has been demonstrated by Piaget and other investigators working with sighted subjects is further confirmed in this investigation with the blind and partially sighted. The necessarily tentative comparisons with some of these other studies would seem to suggest that while the best of the visually handicapped attain conservation as early as 6 or 7 years and are, therefore, equal to the best of the sighted, there is a greater spread among them, with a substantial number not conserving until beyond the age of 9 or 10. These findings are in line with those of Gomulicki on the slow development of perceptual skills among the blind.

How far this developmental lag is attributable to restrictions in the extent and quality of the visually handicapped child's learning experiences and interactions with his environment is difficult to assess. It may be that visual impairment reduces the number of those entirely fortuitous experiences in which, for the sighted child, the inadequacy of his existing schemata is borne in upon him. A comparison of the home and other pre-school backgrounds of, for example, conserving and non-conserving blind 6-year-olds would be one indirect way of testing the hypothesis that differences are traceable to the nature and complexity of the stimulation received. An alternative, and more direct, method of investigating this hypothesis would be through experimental comparison of different kinds and intensities of training, along the lines of those used by Smedslund (e.g., 1961). The importance of the school in making good these deficits (if these are, in fact, the cause of the observed wide disparities in performance) would seem to need little underlining. Whether or not the needs of the visually handicapped child are best served within our present segregated system, provision for accurate diagnosis, and appropriate compensatory teaching, must be made. In so far as Piagetian conservation tasks have both a diagnostic and a learning component, their value to teachers of the visually handicapped is considerable.

Although the present study was unable to show any differences attributable to degree of vision, the need for further research on this aspect of the problem is clear. With the possible exception of comparisons between the totally blind and the partially sighted, further advances in our understanding of the effects of visual handicap will depend on the development, by ophthalmologists and other specialists, of more refined measuring procedures. At the moment, classification has to be on a somewhat coarse basis, with the groupings lumping together subjects with widely differing levels of visual efficiency.

Piaget's use of the term 'reversibilité' has been a source of some difficulty and misunderstanding but, if it has been correctly interpreted in this study, then it would appear that, as Lovell and Ogilvie found, the attainment of reversibility is not of itself a sufficient condition for the attainment of conservation of substance.

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(Manuscript received 19th October, 1971)

SOCIAL CLASS AND CHILDREN'S UNDERSTANDING OF DEEP
STRUCTURE IN SENTENCES

BY M. HEZLETT DEWART

(Department of Psychology, Queen's University of Belfast)

SUMMARY. An attempt was made to test children's ability to comprehend passive voice sentences and related sentence structures in which deep and surface structure differ considerably. 44 children (aged from 5:3 to 6:6) from two social class groups were asked to manipulate objects to correspond to sentences spoken by the experimenter. Middle-class children made fewer errors than working-class children. The findings suggest that there may be social class differences in the rate at which children acquire a mastery of the syntactic rule system of the language.

INTRODUCTION

Studies in developmental psycholinguistics, both observational and experimental, have tended to concentrate on children from middle-class backgrounds and of average or above average intelligence. Recently Griffin (1968) has speculated that the child from a working-class background may not be as advanced as his middle-class counterpart in transformational aspects of language. Indeed, there is some evidence (Osser, Wang and Zaid, 1969; Nurs and Day, 1971) that this is the case.

The present experiment was planned to test for social class differences in children's understanding of sentences involving the passive voice and related sentence structures in which the surface structure subject and deep structure subject do not coincide, that is, where the grammatical subject and the logical subject of the sentence are different. The rules for recovering the deep structure, on which generative linguistic theory (Chomsky, 1965) says comprehension depends, are therefore somewhat complex, and the ability to use them is a relatively late acquisition (Turner and Rommetveit, 1967).

The frequency of using passive voice sentences had been found to vary reliably with the social class of the speaker (Bernstein, 1962; Lawton, 1968), but apart from a study by Peisach (1965), little work has been reported on subcultural differences in the comprehension as opposed to the production of language. Experimental psycholinguists have recognised that comprehension probably reflects underlying linguistic competence much more clearly than production, and have devised experimental techniques to assess the child's comprehension of sentences from his non-verbal responses in a test situation.

The present study employs two such testing procedures, that devised by Huttenlocher, Eisenberg and Strauss (1968) and that devised by Cromer (1970). Both working-class and middle-class children were tested. In addition, their verbal IQ was assessed by the Peabody Picture Vocabulary Test (PPVT).

METHOD

The experiment fell into two parts, with the same children serving as subjects in each part. Subjects were tested individually in a session lasting approximately 20 minutes in a quiet room in their school. The PPVT was administered first, according to the standard instructions; then followed Part I of the procedure, which was followed immediately by Part II.

Subjects.

The subjects were 44 children whose ages ranged from 5:3 to 6:6, the average age being 5:8 at the time of study. 22 were pupils at a fee-paying preparatory department of a grammar school and constituted the middle-class sample. The working-class sample consisted of 22 pupils at a primary school in a working-class area. Each social class group consisted of an equal number of boys and girls.

The selection of working-class subjects from those available was influenced by an attempt to avoid having social class groups which differed markedly in IQ. The mean IQs obtained from the PPVT were 106 for the middle-class group and 103 for the working-class group. This difference is not statistically significant ($t=0.77$, 42 df).

Materials.

In Part I of the experiment the testing materials were essentially the same as those used by Huttenlocher *et al.* (1968) and consisted of a board 4×9 inches (101.6×228.6 mm) which was divided by strips of wood into three equal sections, each large enough for one toy car to sit inside. Two toy cars were used, identical except that one was red and one was blue. In Part II the materials consisted of two colourful rubber 'Bendi' hand puppets, one the head of a duck and one the head of a wolf, identical to those used by Cromer (1970). The child's hand fits inside these so as to allow him to open and close the puppet's mouth.

Procedure.

When the PPVT had been administered, the materials for Part I were produced and the child was instructed as follows: "I want you to imagine that this is a road and these are two cars going along the road. Show me the red car. The road is divided into three parts. I'm going to put one of the cars in the middle. The car always faces in this direction towards the . . . (experimenter supplies window, door, etc., as appropriate). I'm going to give you the other car into your hand and ask you to make it so one car is pushing or pulling the other one. A car has to be behind the car it is pushing, like this (experimenter demonstrates). It has to be in front of the one it is pulling, like this (experimenter demonstrates). So now the red car is pulling, but now it is . . . (subject supplies 'pushing' to experimenter's rising intonation). Each time I'm going to tell you how the cars should be. You listen and put your car where you think it should be as soon as you know."

Before reading each sentence the experimenter placed one car on the centre section of the board and gave the child the other car. The subject's task was to place his car (MC for 'mobile car') in front of or behind the car already placed by experimenter (FC for 'fixed car').

There were eight types of sentence, two examples of each type being presented to each child. The eight types represented every combination of three two-valued variables, namely,

- | | | | |
|-----|---------------------------------|---------------|---------------------------------|
| A : | (1) active voice | <i>versus</i> | (2) passive voice |
| B : | (1) F.C. as grammatical subject | <i>versus</i> | (2) M.C. as grammatical subject |
| C : | (1) grammatical object stated | <i>versus</i> | (2) grammatical object unstated |

Thus, assuming the F.C. was red and the M.C. blue, the eight sentences would have been as follows :

- | | |
|--|--------------|
| The red car is pushing/pulling the blue car | (A1, B1, C1) |
| The blue car is pushing/pulling the red car | (A1, B2, C1) |
| The red car is pushing/pulling | (A1, B1, C2) |
| The blue car is pushing/pulling | (A1, B2, C2) |
| The red car is pushed/pulled by the blue car | (A2, B1, C1) |
| The blue car is pushed/pulled by the red car | (A2, B2, C1) |
| The red car is pushed/pulled | (A2, B1, C2) |
| The blue car is pushed/pulled | (A2, B2, C2) |

In fact, the colours of F.C. and M.C. were reversed in half of the sentences presented to each child. Half of the sentences used the verb 'push,' and half the verb 'pull.' The 32 possible sentences were divided into two sets of 16 in such a way that each set contained two examples of the eight basic types, with the 'red/blue' and 'push/pull' variables counterbalanced. Individual subjects were tested with one of the two sets of 16 sentences in one of two random orders. They were allocated randomly into four groups receiving one of these four forms of the test.

Before Part II of the experiment the child was shown how to operate the two puppets, one on each hand, and how to make one appear to bite the other (on the ear so that the experimenter could plainly see which was doing the biting). Part II of the experiment exactly replicated the procedure used by Cromer (1970). It consisted of five sections, each section being presented to each child in the same order.

Section 1 consisted of two simple active sentences spoken by the experimenter :

"The wolf bites the duck. Show me that"

"The duck bites the wolf. Show me that."

In Section 2 eight sentences were presented, all having the structure

"The wolf/duck is . . . to bite."

The blank was filled either with one of four 'S-type' adjectives (happy, anxious, willing, glad) which when used in this structure indicate that deep structure subject and surface structure subject coincide (that is, the grammatical subject is logically doing the biting), or with one of four 'O-type' adjectives (tasty, easy, hard, fun) which in this structure indicate that someone other than the surface subject is doing the biting. A counterbalanced design controlled for order effects in terms of the type of adjective ('S-type' or O-type') first presented and for any effects due to the choice of animal as surface subject for each adjective (half the subjects having the duck as surface structure subject, and half having the wolf, for every adjective).

There were four sentences in Section 3. They used the same structure as the sentences in Section 2 but this time the blank was filled with one of four 'A-type' adjectives (bad, horrible, nice, nasty) which in this sentence frame are ambiguous, the interpretation of actor or deep subject depending on the context. The four sentences in this section were controlled, as in Section 2, for the pairing of particular adjectives with duck and wolf. Ten different orders for Sections 2 and 3 were used, the subjects being assigned randomly to one of 10 counterbalanced design groups. Section 4 was made up of two passive sentences :

"The wolf is bitten by the duck. Show me that."

"The duck is bitten by the wolf. Show me that."

RESULTS

Part I

The scoring procedure was based on the frequency of errors, that is, of cars wrongly placed. Preliminary analyses indicated no significant differences (a) between sentences using the verbs 'push' and 'pull,' and (b) between sentences with the grammatical object stated *versus* unstated. An analysis of variance was carried out for the three remaining variables, namely, social class, sentence voice, and 'mobility' of the grammatical subject (i.e., whether the grammatical subject was M.C. or F.C.). The main effect of sentence voice was highly significant ($F=89.63$, $df=1, 24$, $P<.001$), passive being more difficult. The main effects of the other two variables were also significant ($P<.01$), but each also interacted with sentence voice, and these interactions affect the interpretation of the findings.

The interaction of social class and sentence voice ($F=5.06$, $df=1, 24$, $P<.05$) is shown in Table 1. Working-class children make significantly more errors than middle-class children on passive sentences ($t=3.48$, $df=14$, $P<.01$). On active sentences, however, the social class difference is negligible.

TABLE 1

PROBABILITY OF MAKING AN ERROR AS A FUNCTION OF SENTENCE VOICE AND SOCIAL CLASS.

	Active	Passive
Working Class	.063	.404
Middle Class	.040	.250

TABLE 2

PROBABILITY OF MAKING AN ERROR AS A FUNCTION OF SENTENCE VOICE AND 'MOBILITY' OF GRAMMATICAL SUBJECT.

	Active	Passive
Grammatical Subject=Fixed Car	·068	·227
Grammatical Subject=Mobile Car.....	·034	·426

Table 2 shows the interaction between sentence voice and 'mobility' of the grammatical subject ($F=15.85$, $df=1,24$, $P<.001$). Among passive sentences, more errors were made when the M.C. was the grammatical subject than when the F.C. was the grammatical subject ($t=4.52$, $df=14$, $P<.01$). Among active sentences, the reverse is true, although the difference is not statistically significant.

Each subject was given a total error score (i.e., the number of errors on all sentence types). This score is significantly related to IQ scores from the PPVT ($r = -0.34$, $df=42$, $P<.05$).

Part II.

Following Cromer (1970), performance on the sentences in Section 2 (i.e., those with unambiguously interpretable adjectives) was used to categorise the subjects into three groups. Children who answer every unambiguous adjective type by showing the named animal (or surface structure subject) as the one doing the biting (or deep structure subject) seem to answer on the basis of a 'primitive' rule of consistently identifying the actor as being the grammatical subject. Thus, they respond to every 'S-type' adjective correctly but to every 'O-type' adjective wrongly. These children were called Primitive-rule Users. A second group, the Intermediates, gave mixed answers to 'O-type' adjectives, sometimes being correct and sometimes wrong. The third group, called the Passers, consistently responded correctly to the items of Section 2.

Table 3 shows the number of subjects in each performance category in relation to social class. The trends in this table are significant ($\chi^2=9.4$, $df=2$, $P<.01$).

Primitive-rule Users were found to have lower IQs on the PPVT than the children in the other two groups taken together ($t=2.06$, $df=42$, $P<.05$).

TABLE 3

SOCIAL CLASS MEMBERSHIP OF PASSERS, INTERMEDIATES AND PRIMITIVE-RULE USERS.

	Working Class	Middle Class
Passers	3	7
Intermediates	5	11
Primitive-rule Users	14	4

The sentences in Section 3, i.e., those using 'A-type' adjectives, allowed of two interpretations, one in which the deep structure subject was the surface structure subject and one in which they were different. Primitive-rule Users might be expected to adopt the former interpretation consistently, and in fact, 16 of the 18 did do so. Only one out of 10 Passers chose this interpretation consistently.

All 44 subjects responded correctly to the active sentences in Section 1, but eight made errors with the passive sentences in Section 4. Of these, seven were working-class Primitive-rule Users and one a middle-class Intermediate.

Relation between Parts I and II.

The eight subjects who made errors on the passive sentences in Part II, Section 4 were found to have made more errors than the remaining subjects on comparable sentences in Part I (i.e., reversible passive sentences with object stated) but the difference was not significant. Of course, the two tasks are not identical, since Part I in addition included the 'mobility' variable.

However, a general relation was found between performance on Parts I and II. Primitive-rule Users made more errors (summed over all sentence types) on Part I than did Intermediates and Passers taken together ($t=3.02$, $df=42$, $P<.01$).

DISCUSSION

As hypothesised, more difficulty was experienced by working-class than by middle-class children on both parts of the experiment. Since on Part I social class differences were significant only on the passive voice sentences, it may be that working-class children of this age are less developed only in their ability to understand sentences involving the more complex transformational rules. The less frequent usage of passive voice sentences by members of the working class (Bernstein, 1962; Lawton, 1968) may well mean that working-class children have less exposure to the structure in parental speech and account for their inferior ability to cope with such sentences.

Again as predicted, a relationship was demonstrated between verbal IQ on the PPVT and performance on both Parts I and II. The relation of IQ to the level of development of syntactic rules in the child is an aspect which surely demands greater attention in the literature. It should be noted that social class differences in comprehension of syntax were obtained although there was no significant difference in verbal IQ scores between the social class groups.

On Part I, the nature of the interaction of sentence voice and 'mobility' of the grammatical subject may shed some light on the processes involved in the comprehension of these sentences. In accord with the findings of Huttenlocher *et al.* (1968), comprehension of the two sentence voices was differentially related to the 'mobility' of the grammatical subject and thus to the extralinguistic situation, being easier when there was a correspondence between the perceived actor in the situation (the mobile car) and the deep structure subject of the sentence, whether the latter comes temporally first as in active sentences or last as in passive sentences.

The results of Part II show that understanding of the structure, "John is easy to see," is a relatively late acquisition. The relationship of chronological age to performance on Part II was not significant. Passers ranged in age from 5;5 to 6;2 but the oldest subject tested (age 6;6) was in fact a Primitive-rule User.

From the results it could be suggested that prior understanding of passive sentences may be a prerequisite for the acquisition of the structure "John is easy to see." 11 of the 18 Primitive-rule Users were able to interpret the passive sentences of Section 4 correctly, showing that they do not assume for every sentence structure that the grammatical subject must also be the logical subject. The general relation found between performance on the two parts of the experiment is a further indication of the relation which may exist between the level of development of one transformational rule and the mastery of other such rules.

The order of difficulty of the sentence structures studied did not always correspond to the order of transformational complexity in terms of Chomsky's (1965) grammar. In Part I more errors were made on full passive sentences than on the shorter but more complex truncated passives (i.e., with grammatical object unstated). Though this difference was not significant, it is consistent with the findings of Slobin (1968) and Hayhurst (1967).

What implications do the results of this experiment have for a theory of individual differences in linguistic behaviour? Though in general terms the findings seem to support Bernstein's theory of a restricted code, it should be noted that Bernstein (1970) has stated: "Because a code is restricted it does not mean that a child is non-verbal, nor is he in the technical sense linguistically deprived, for he possesses the same tacit understanding of the linguistic rule system as any child (p. 118). Perhaps when we know more of this 'tacit understanding' we will find that it develops later in working-class children than it does in middle-class children.

This suggestion is consistent with Cazden's (1965) argument that subcultural differences in linguistic behaviour require a 'weaker' version of the hypothesis of universal linguistic competence. The 'weaker' hypothesis would hold that competence may be the same for all mature members of a linguistic community but may differ in the rate at which it is developed or acquired.

ACKNOWLEDGMENT—The author wishes to express her thanks to Dr. W. P. Brown for supervision of this research and for his advice on the preparation of this paper.

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(Manuscript received 2nd November, 1971)

BOOK REVIEWS

ANTHONY, A., *et al.* (1971). *The Edinburgh Articulation Test*. Edinburgh: E. and S. Livingstone, pp. 83, £12.22.

The primary aim in constructing this test was to provide speech therapists with a device to identify children between 3 and 6 years of age who need treatment. The authors discuss the deficiencies of existing tests and show how in Edinburgh they devised an easily administered, interesting, economical and locally valid form.

The test requires spontaneous naming of attractively drawn pictures, the responses being familiar words for young children. It is shown that an acceptable alternative in cases of incorrect or absent response is repetition of the tester's naming of the picture. In most responses two or three articulatory units are tested in different word positions, those which were found to discriminate well between different age levels and between normal and deviant speech being well represented. Only some consonantal phonemes and groups are included, the phonological system being sampled so that 41 words give 68 units for testing. Item selection was based on responses from 130 normal and 57 speech retarded children, and a small scale validation test of the final form is claimed to have successfully identified, without exclusion, those children in need of therapy.

Only trained phoneticians can record the responses, their transcripts then being checked against a tape-recording before scoring is attempted. Each unit is scored right or wrong against the local adult norm as criterion. Examples of admissible forms in Edinburgh are given and the scoring has been standardised for each three-month age group on a total sample of 510 children. One wonders, however, whether the inter-tester reliability reported for the two phoneticians who undertook most of the work would be maintained by others. To supplement the quantitative scoring a quantitative analysis of errors enables the tester to determine whether low scores are due to retarded or deviant development.

Although the authors have produced a considerably improved form of articulation test the question of its usefulness for speech therapists generally and for students of speech and language development raises considerable problems. Unfortunately for the latter a screening test comprised of selected items cannot suffice for the study of the development of the phonological system. Furthermore, since doubt exists as to how far the phoneme is an appropriate unit for analysis of developing articulation, the test may be even more limited in its usefulness. Perhaps the most telling doubt, affecting both research and screening, is that until the test has been tried out in other localities it is impossible to say what changes of item and specification of acceptable forms might be required. The authors are, nevertheless, undoubtedly right to base their work on local speech norms, their test offers the possibility of modification to suit other localities, and the quantitative analysis of error is a most valuable model for an approach to diagnosis and therapy.

HAZEL FRANCIS.

BRIDGELAND, M. (1971). *Pioneer Work with Maladjusted Children*. London: Staples Press, pp. 400, £3.95.

"It may be argued," says Mr. Bridgeland (p. 263), "that before anyone can be regarded as a 'pioneer,' he must not only do something which is original but must point a way that others may follow. His individual practice must lead to theory, or some body of practical directions, which can be generalised from . . ." If this is so, the pioneers with whom his book is concerned miss out. Most of them felt little need to conceptualise their methods or test their results. They almost seem to glory in playing it by ear. Lucy Francis' remark "I didn't work it out; I just did it," is typical.

Mr. Bridgeland has thus set himself a task of no ordinary difficulty in seeking to trace "the development of therapeutic education" (his sub-title) from their work. He does so mainly by organising the subject matter historically, outlining the careers and describing the methods of the outstanding names, showing how each was influenced, what their practice had in common, and in what they were original.

He finds the origins of the work in the efforts of such nineteenth century precursors as Mary Carpenter and Devine, whose concern expressed itself in child-care and club approaches, respectively. Later came the 'originals'—such men as Hunt and Hoare. In the present century, 'progressive' schools, influenced by the 'new education' movement (from about 1910) and the 'new psychology' sometimes with 'Freudification' (from about 1920) contributed. The inter-war years threw up a number of relevant experiments, mainly with delinquents, to which Mr. Bridgeland pays a good deal of attention. Fresh impetus came with the problems deriving from evacuation and war-time disruption. The work of Wills and other less known workers is described in some detail. After the 1944 Education Act, the State and the LEAs began to take over the care of the maladjusted and Mr. Bridgeland dates the close of the 'pioneer era' from the founding of the Association of Workers for Maladjusted Children in 1951.

When he reports on the pioneers' methods and views, Homer Lane stands for Mr. Bridgeland as the archetype. Lane's credo included emphasis on love, freedom, and self-government, all in a co-educational setting. These ideals with important individual modifications re-appear in the practice of many of his successors. Small, residential mixed communities are preferred by most of the pioneers as providing the ambience appropriate for their work, but the only conceptual label which Bridgeland identifies as having any general applicability is Franklin's recently arrived at 'planned environmental therapy.' But this, as the author further points out, is "not so much a theory as a plan of action based on experience," and "produced largely by the personalities of those actually involved."

This last quotation introduces the factor which emerges as undoubtedly the most characteristic feature of the pioneers' approach to maladjustment: for each it is the expression of his individual vision and insights. On some matters, indeed, they drew inspiration from others but first and last it was their own intuitions that guided them. They mostly appear as way out, charismatic people whose treatment methods have no common denominator except the fundamental preference for the therapy of love as against the sanctions of punishment. 'Hard work,' psycho-analyses, 'common sense,' are among the different remedial measures harnessed to this central idea. Except in the case of Otto Shaw at Red Hill (p. 169) no figures exist to support the methods chosen and such studies as we have (p. 336 ff.) are slight and inconclusive.

How then does Mr. Bridgeland rate the pioneers' influence? It would not seem very great or obvious. In spite of their early and continued interest in delinquents they have made little impression on approved school methods, while in dealing with the child diagnosed as maladjusted many modern LEA schools and private schools are relatively conventional and pay a good deal more attention to the classroom side than most of the pioneers ever did. Bridgeland himself indeed seems to favour rather new sorts of experiment (e.g., units within ordinary schools) and heralds as due the arrival of a new race of 'professional pioneers' of a more scientific turn of mind.

The book has brought together an amount of scattered material in a useful and interesting way. It has a lengthy bibliography and some helpful appendices, but is very expensive.

OLIVE C. SAMPSON.

CANE, B., and SMITHERS, J. (1971). *The Roots of Reading*. London: NFER, pp. 95, £1.25.

Most of those whose research has led them into schools will agree that differences between the schools may often be as interesting as the differences between the groups of children being studied yet may have to be put to one side as not being relevant to the main issue. In this report we have one of the few attempts to explore systematically some of the differences between schools with particular reference to reading attainment. The data, which were collected in 1958-60, describe 12 of the schools which took part in Dr. Elizabeth Goodacre's study of reading in London infant schools and departments. These schools, which were in lower working class areas with intakes roughly homogeneous in terms of social class (and as a comparison, a further four schools from middle class areas), were studied in great detail, concentrating on the methods of teaching reading, the organisations of the schools, their teachers and pupils. Information was available from the questionnaires used for the whole sample (which included these schools), tests and estimates of the children's reading readiness from the whole sample as well as detailed observation of these particular schools, results of the Harrison-Stroud Reading Readiness Profile for all their children and detailed testing of 116 children who were either the most or the least ready to read. It would have been helpful if the schedules for the questionnaires and teachers' estimates had been included with this report; not all readers will have immediate access to the two preceding books.

It is claimed that, although the particular schools will have changed in the 10 years between the completion of the fieldwork and the presenting of the findings, the differences found between them and the relationship with the reading achievement of the children are relevant to the present situation. The 12 schools were ranked according to their success in teaching reading, taking into account the initial readiness of the children. On the whole, the more successful schools were also those with more teacher direction and, of these particular schools, the more 'progressive' tended to be the least successful. The important finding is that the successful schools were distinguished by the existence among the teachers of clearly defined objectives, the presence of systematic instruction (in phonics and other aspects of reading) and some kind of organised teaching programme as well as eclecticism in the approaches used. In a word, the schools were structured with reference to reading which, as the authors point out, is not at all at variance with progressive theorists who also stress the need for a structured curriculum.

From the testing of the children they provide further evidence for the need for adequate diagnostic testing as they start school and suggest that selective use of subtests from the Harrison-Stroud Reading Readiness Profile (visual and auditory discrimination) might be more effective than reliance on the teachers' estimates alone.

The value of this report is that it clearly shows the effect of lack of structure of the learning situation on the achievement of the children and it is to be hoped that there will follow from it more research which takes the school or the teaching group as the unit to be studied.

JENNIFER RUSSELL.

DAHLÖF, U. S. (1971). *Ability Grouping, Content Validity and Curriculum Process Analysis*. New York: Teachers' College Press, pp. 100, \$7.95.

The grouping of pupils for classroom instruction is one of those perennial problems that have plagued teachers and researchers alike since mass education began. The evidence on the importance of teacher attitudes and classroom practices provided by Barker Lunn* has hopefully clarified the problem at least at the primary level, but with the continued development of the comprehensive school, the situation at the secondary level still remains somewhat confused. This book by Professor

Dahllöf should lead to a greater understanding of the problem and hopefully to some better oriented research.

Dahllöf was intrigued that earlier grouping research—particularly the famous Stockholm study by Svensson†—appeared to suggest that when intelligence and social background were held constant, being in homogeneous or heterogeneous ability groups had little or no effect on pupils' achievement levels. This implied that the answer to Husen's and Boalt's famous question concerning selective education systems: "What price has to be paid for the high standard achieved by the few?" was no price at all. Echoing Barker Lunn's results (which mysteriously he does not mention) Dahllöf argues that achievement can never be a direct outcome of grouping arrangements but must be related to the teaching process—to the methods of instruction and to the time required for learning elements of the curriculum. It follows that more attention should be paid to the content validity of criterion measures used in grouping research.

Dahllöf carried out a reappraisal of some of the earlier studies on grouping, including that by Svensson. He also undertook an empirical analysis of the content validity of the achievement tests used to assess performance in mathematics, and of the teaching time devoted to different aspects of curriculum. His results led him to propose a research paradigm which he characterises as a macromodel in contrast to the micromodels concerned with classroom experiments in teaching and learning. In his general model, final achievement in a specified curriculum unit is seen as a function of initial ability, the level of objective aimed at and the time devoted to that curriculum unit. He also hypothesises that the rate of teaching in traditional classroom instruction is steered by pupils at the lower end of the ability distribution of the class.

He concludes that ability grouping or streaming is more effective for the brighter children than traditional classroom teaching in comprehensive classes. If the latter is still maintained, therefore, there is a price to be paid—less work (curriculum units) will be covered and a lower standard achieved with more advanced objectives. Dahllöf is able to point out, however, that individualised instruction is the most effective procedure of all, but stresses the difficulty of achieving this in classes of great heterogeneity unless there are "preconstructed programmes and other teaching devices at hand."

D. PIDGEON.

* BARKER LUNN, JOAN C. (1970). *Streaming in the Primary School*. NFER: Slough.

† SVENSSON, N.-E. (1962). *Ability Grouping and Scholastic Achievement*. Stockholm Studies in Educational Psychology, No. 5. Almqvist and Wiksell.

‡ HUSEN, T., and BOALT, G. (1967). *Educational Research and Educational Change*. Almqvist and Wiksell.

DALE, R. R. (1971). *Mixed or Single-Sex School. Vol. II—Some Social Aspects*. London: Routledge and Kegan Paul, pp. xii + 360, £5.25.

This is the second volume presenting the results of Dr. Dale's comparison of co-educational and single-sex schools in respect of their influence on the social and emotional development of their pupils. The data were obtained by means of questionnaires and personality tests directed towards attitudes and behaviour in a wide range of pupils and ex-pupils. The pupils were drawn from grammar schools in two large regions, selected to be representative by the Welsh branch of the Department of Education and Science and the West Riding Local Education Authority. The ex-pupils were all students training to be teachers, a sample which has both advantages and limitations which Dr. Dale notes. In addition the returns from 500 teachers who had taught in both mixed and single-sex schools were examined, since these were likely to be the best informed. It is clear, as Dr. Dale agrees, that there were some limitations in the sampling.

The author displays the thoroughness and caution we saw in his first volume, and indicates clearly the need for further study of many questions which he takes up. It is a pioneer work which with impressive consistency supports the preference for co-educational schools as "providing the happier, more balanced, more interesting and more complete education." There is also a study of 'amalgamated' schools (single-sex schools which have become co-educational). Here the response was less favourable, probably because of the predictable difficulties of transition. The sample of male pupils, however, was too small for reliability, and this question needs further exploration. Much of the data also has more general implications (e.g., for discipline, curriculum, method and personal relationships in school) which will interest many readers. The questionnaires included opportunities for free responses, and it is clear from these and from the structured responses that many present pupils and mature ex-pupils are dissatisfied with their secondary grammar school education as a preparation for life in the adult world, but it can be said that dissatisfaction was less in co-educational schools.

We are promised a third volume comparing the two types of school in regard to the academic attainment of their pupils.

A. H. STEWART.

ELKIND, D. (1970). *Children and Adolescents: Interpretive Essays on Jean Piaget*. London: Oxford University Press, pp. 160, cloth £2.70, paper £1.00.

This collection of nine essays is designed to fulfil a need for a "less technical introduction to Piaget that would be appropriate to students of education."

The preface provides an interesting account of Piaget's growing international reputation and suggests that in America his popularity is associated with the trend in educational opinion that the goal of education is not the personal adjustment of pupils but rather the deliberate cultivation of the ability to think.

The first five essays are concerned with Piaget the man as well as his work. The biographical detail is illuminating, the explanation and interpretation of his concepts apt and often aphoristic.

However, the main intention of the book is not to summarise Piaget—there are an increasing number of books which already provide this service—but to point the implications for the teaching of children. The essays entitled 'Piaget and Education', 'Piaget and Montessori' and 'Two Approaches to Intelligence' do just this. The latter is a useful comparison between the Piagetian and the psychometric, factor-analytic description of the nature of intelligence. This essay ends with a consideration of some important practical issues: the effectiveness of pre-school education in fostering intelligence; the place of intrinsic motivation in education; and the possibility of psychometrizing Piagetian tasks. His views on each of these questions is refreshing and well documented. Throughout the essays the exposition of debatable issues is plain and direct but for the interested reader an extensive list of references to source material is given. Of the 118 references in this slim volume 17 are to Piaget's own work and 21 to papers by Professor Elkind and his collaborators.

There is much in these essays which comes from Professor Elkind rather than Piaget. This is particularly so in the last essay on 'Reading, Logic and Perception,' an application of Piaget's account of the mechanisms of perception to the teaching of reading. In this there is a detailed account of exercises designed as an ancillary aid to promote reading skill. They are interesting in their own right whereas the link with Piagetian terminology and theory seems, at times, somewhat forced.

Throughout the essays the point is repeated that Piaget did not set out to construct an educational theory or programme. In a lucid, entertaining and imaginative way Professor Elkind has drawn his version of the educational implications of Piaget's work.

LAWRENCE LITT.

GLOCK, M. D. (Ed.). (1971). *Guiding Learning*. London: J. Wiley, pp. 764, cloth, £5.00; paper £3.50.

The sub-title of this book is "Readings in Educational Psychology," but a more accurate description would be "Readings in American Educational Psychology," as all the 50 selected papers are by American authors. Admittedly, Piaget is mentioned more frequently than any other psychologist, apart from Bruner, but none of his own writings is included. As these readings constitute the basic text for the editor's course in educational psychology it seems likely that this inbred tendency will continue. It makes one wonder, however, to what extent educational psychology can be regarded as a science. Surely, universality is one prime requirement of a science. In the last part of the book, Carroll concludes that educational psychology can be classified as a discipline, but Wittrock notes that research in this field "has not progressed far toward the development of an organised body of knowledge relevant to the understanding and the control of instruction and teaching." On the evidence provided in the other five parts of this book, one is inclined to agree.

The introductory chapter is concerned with popular descriptions of what goes on in American schools, while the second part deals with the role of the teacher. Various aspects of educational technology are included under this heading: educational objectives, feedback, computerised instruction and audio-visual aids. Individual differences are discussed in the third part of the book, where a number of papers are devoted to the characteristics of learners, including Guilford's 1965 model of intelligence. The fourth part of the book is devoted to teaching and learning and includes chapters on motivation, the cognitive, affective and psychomotor domains, and the problems of retention and transfer of learning.

The following section, on measurement and evaluation, is perhaps the most important, as the individual and social consequences of education and assessment are discussed. Glaser's short but valuable article, distinguishing between norm-referenced and criterion-referenced tests, is as pertinent now as it was when it first appeared eight years ago. The problem of selecting appropriate criteria remains, and must be related to the choice of educational objectives. It is here that one feels most in need of an overall philosophy and a guiding framework. The connecting theme used in this book hardly serves this purpose. It is taken from an article by Coladarci, which is not included but which "maintains that the effective teacher formulates defensible hypotheses as a basis for teaching acts." Glock uses the articles included in this book to provide his students with "suggestions for varied decisions that will be necessary for them to make as teachers." In this respect it is probably helpful, but many students would no doubt prefer a shorter and cheaper book, especially if it offered a more creative and better integrated framework for guiding both learning and teaching.

G. W. H. LEYTHAM.

GULLIFORD, R. (1971). *Special Educational Needs*. London: Routledge and Kegan Paul, pp. 213, £2.

This is most comprehensive survey of the various handicaps which make special educational provision necessary for some children and of the ways in which this provision can be satisfactorily made. It deals systematically and fully with its wide range of topics—physical handicaps, learning and communication difficulties, emotional, intellectual and social problems—not forgetting those children who are multiply handicapped. Within these topics there is recognition of finer discriminations; reference is made to aspects not always recognised, e.g., the problems of children with defective colour vision meeting modern teaching techniques which use coloured rods or coloured words. It is refreshing, too, to find that the controversial handicap of autism is at last classified under communication difficulties and

discussed in a competent way which recognises the limits of present knowledge. Generally the treatment shows the continuity of education; it avoids making rigid divisions or suggesting that different handicaps must be dealt with in isolation; the reader is brought back to the possibilities of bringing handicapped children into ordinary schools or using at least the same basic methods in teaching them with due allowance for their stage of development and handicap. There are indeed comments on general teaching techniques and principles which are capable of wide general application.

The teacher will find a good review of research findings related to the various handicaps and information about various kinds of schooling and methods. There is also an introductory outline of social and welfare services which is useful if rather limited to provision in England. Possibly it is not always clear how much previous knowledge the reader is assumed to have: on the whole a knowledge of Piaget's work seems expected, though there are some explanatory comments, but Erikson's scale of emotional development is fully given as are such things as Redl's list of teacher behaviours used in controlling pupils. The style might occasionally be rather too closely packed, but the author does usually explain his references and provides at the end of sections very helpful short lists of further reading. Probably this is not the kind of book to be read straight through, as it is rather too fully packed for that, but if it is read, as the author expects it to be in many cases, in conjunction with visits to schools or by practising teachers it should be an ideal complement to such experiences of individual children and their behaviour. Certainly it seems likely to serve well the purpose for which it is mainly intended, that of providing accompanying or initial reading for teachers following a course of study. It will also be a most useful handbook for anyone with an interest in children whose education presents special problems.

MARGARET B. SUTHERLAND.

HILSUM, S., and CANE, B. S. (1971). *The Teacher's Day*. London: NFER, pp. 311, £3.80.

The appearance of this comprehensive, systematic and objective account of the teaching day will, without doubt, stimulate vigorous discussion. The book contains a well presented mass of information gathered from 129 representatively sampled teachers working in 66 Surrey junior schools. The data, gathered during un-announced, though approved, observation sessions in the classrooms and schools, contains information, often ingeniously collected, on variations in schools' working times, on the classification and analysis of the content of the teacher's day, on the analysis of variations in teaching days and on a resume of 'special' aspects of the teacher's day. The nine appendices, nearly one-third of the book, that are concerned with the methodological problems encountered and the techniques utilised are unusually comprehensive and will be of special value to those who wish either to duplicate or to follow up this research. It is a part of the presentation that can be especially recommended.

The strength of this book most certainly lies in its comprehensive presentation of data, and in the consequent conclusions to be drawn. The variations in school administrative arrangements with regard to the length of break times, finishing times, time allocated to teaching sessions and teachers' off-duty, have serious implications for the capacities of teachers to undertake curricular and extra-curricular activities. The analysis of work content will no doubt provide a spark to debate in many quarters. We are informed, for example, that only 26 per cent of the total working day was taken up with 'instruction'; that 40 per cent was occupied in 'essential related work' (organising pupils, lesson planning, consultation, marking and reading); nearly 25 per cent of the day was spent on clerical and mechanical chores and supervision. A mere 2 per cent was spent on pastoral work (chatting to pupils) with individual pupils—so much for Plowden *et al.*!

The section of the book concerned with variations in the teaching day provides less dramatic though equally important information. The teacher characteristics studied (experience, sex, dependents and responsibility) had little influence on instructional work in the classroom. Some myths are exploded: evening preparation was undertaken as much by experienced staff as by newer members of the profession (the authors acknowledged the dangers of self-administered questionnaires). Within the classroom the most startling finding was that class size and the ability range in any one class had little effect on the style of teaching. The authors also suggest the establishment of experimental deployments of teacher-helpers to enable the most appropriate help or service to be developed.

The weakness of the book lies in the theoretically limited objective of merely recording teacher behaviour. This leads, for example, on the one hand to extremely ingenuous and cursory assumptions about the expectations of members of the teacher's role-set, and on the other hand to rather tediously presented reports, which are, however, often mercifully relieved by well-constructed case studies and 'typical' situations. The book will make an important contribution to the dialogues on the teacher-role and on teacher training, and will provide an excellent basis for further research.

P. ROBINSON.

KAGAN, J. (1971). *Change and Continuity in Infancy*. New York: John Wiley, pp. 298, £4.85.

In recent years the concept of infant intelligence has assumed a new look. It is no longer Gesellian in its approach, with an emphasis on motor behaviour, but is instead based on a view of the infant as a cognitive being that receives and retains sensory impressions, forms hypotheses, and follows rules long before it is motorically capable to any extent. Moreover, there are various suggestions that marked individual differences in the efficiency of such operations are discernible fairly early on, and that these differences may already be determined by forces within the child's social environment. With the present interest in cultural deprivation, early education, and pre-school enrichment, someone was sooner or later bound to take advantage of this new look and carry the examination of the nature and determinants of individual differences in cognitive functioning back into the first year.

In this book Kagan describes the results of a longitudinal study carried out on a group of 180 infants, between the ages of 4 and 27 months. The techniques used for their assessment varied somewhat from age to age, but were largely based on the assumption that attentional variables provide the most telling clues to cognitive efficiency: variables such as the amount of response decrement to a repeated stimulus pattern, the degree of awareness of a discrepant stimulus, the differential orientation to familiar and unfamiliar auditory stimuli, and the motoric excitement produced by unexpected events. In his choice of response measures Kagan casts his nets widely; he studies the effects of his experimental manipulations on visual fixation, vocalising, motor activity, smiling, crying, and heart rate, and it is under the headings provided by these response systems that the findings are reported. They are related, moreover, to such variables as age, sex and social class, providing a great mass of data on situational and developmental stability as found in these various groups of subjects.

The patterns which these data assume are often complex and bewildering and occasionally ambiguous. The ingenuity with which Kagan attempts to interpret them is considerable indeed and, though not every one will unreservedly follow his suggestions, their provocative nature cannot be denied. In relation to the frequently obtained sex differences, for example, Kagan is prepared to entertain both genetic and psychodynamic hypotheses to account for them; given the confusion in the literature about sex differences in early behaviour, one must also, however, wonder

whether one is not simply confronted by a failure to replicate findings obtained from different groups. Again, while Kagan is particularly interested in response stability over age and discusses this issue at length, indices that are described as showing good stability frequently turn out to have correlations over age as low as .25. Rather more caution is required in handling such data than Kagan's evident enthusiasm allows.

The social class differences in cognitive functioning represent probably the most interesting part of the study. Kagan concludes that such differences emerged during the first year and became unequivocal by 27 months. In this respect his measures are more sensitive than conventional techniques, for the Cattell Infant Intelligence Scale failed to locate any class differences. It is particularly in the distribution of attention that such early class-related differences emerged, though they tend to be more apparent among girls than among boys. If this is indeed the case the present American vogue for early education will need to go right back to babyhood and initiate remedial procedures before the child has even left the cradle. Once again, however, detailed inspection of Kagan's tables suggests that caution is required and replication of these findings is called for before a new profession of baby teachers is called into being. In the meantime, however, this book, with its mass of provocative findings, must be treated as an important and stimulating contribution to the literature of early intellectual development.

H. R. SCHAFFER.

KELSALL, R. K., and H. M. (1971). *Social Disadvantage and Educational Opportunity*. London: Holt, Rinehart and Winston, pp. 217, £1.45.

Definitions of social disadvantage are more likely than not to be idiosyncratic. The authors of this book apply the term to the unfavourable conditions in the environment—family, neighbourhood and school—which prevent children in underprivileged urban areas from functioning as adequately as they might in the educational systems of Britain and the United States. Three assumptions are, therefore, made: first that the majority of underprivileged children is to be found in inner urban settings, second that their educational potential is greater than their achieved level of performance, and third that the education offered fails, as far as socially disadvantaged pupils are concerned, not because of faults in the educational system as a whole but because of their inadequate adjustment to it.

The middle chapters of the book, which are well done, do examine the controversial nature of these assumptions to some extent. The handicaps inherent in poverty, large families, parental unconcern and lack of contact between home and school are discussed, as well as the effect that the 'social mix' within any school has on pupil performance. Ways in which disadvantaged pupils fail to conform to their teachers' or school's expectations and the adverse effect of this lack of congruity on the attitudes of all concerned are looked at. Some of the unfavourable results of particular forms of school organisation are outlined.

It is inevitable in a book of this size that some major points will receive scant attention. Jensen's arguments on differential genetic endowment, for example, are barely acknowledged. Nevertheless, the authors do pause every so often to analyse important issues in detail—alienation, the Head Start programmes, streaming, value orientations, self perception. Students in training will find the clear, balanced appraisal of these issues more than merely an introduction to the material in question.

The first chapter, where the authors delineate their concept of social disadvantage is the least successful. The inclusion of dyslexic and autistic children in the category of the socially disadvantaged is neither convincing nor particularly helpful. It is not clear whether children of low ability in the normal school are included in the author's classification or not. There are too many generalised statements and global categorisations. As a basis for discussion, however, its

strength lies in its weaknesses. If tutors are looking for a basic book on this topic which will both inform and provoke, this one can be highly recommended.

ALICE F. LAING.

LAING, R. D. (1971). *The Politics of the Family*. London: Tavistock, pp. 133, £1.50.

Most collections of essays or talks by a single person tend to contain an irritating amount of repetition and this criticism has some basis in the present instance. However, the quality and enthusiasm of Laing's latest offering is quite high enough to assuage the vexation of all but the frostiest pedant. One might be more concerned about the very heavy emphasis on pathological outcomes and extreme situations, but the lines of argument do take a more general standpoint and, as Laing himself points out, forces are more easily discerned where the pressures are extreme. Whether this is completely true of all 'normal' situations is arguable but few would disagree that our own richest source of naturalistic material, our own life circumstances, is too subjective and involving to do much more than start us off with some idiosyncratic notions of how things work and the capacity to empathize with what we observe.

In the first part of the book, Laing presents many of the familiar ideas about schizophrenia which he has developed in previous books. Many will no doubt feel that his explanation of the aetiology of schizophrenia places too much responsibility on the family in view of accumulating evidence for the genetic/biochemical component. But, given that Laing is not insisting that the sufficient cause of schizophrenia is always psychological, one must agree that his approach to the problem is potentially extremely useful. After all, to put our trust too solidly in the 'philosopher's stone' of chemical causality is all too likely to have the same dismal effects as those deriving from the arch-chemist, Kraepelin. That is to say, people trapped in the limbo of interminable care and sedation in hospitals until research should reveal a simple medical cause and treatment. Of course, one hopes that such a dramatic 'break-through' might happen, but the results of the concomitant laissez-faire have been truly inhuman and too inefficient to inspire any confidence in simplistic medical models. Whether or not these prove to have an important part to play in the future, the problems continue to be in the present and Laing's approach is a well thought out prescription for positive action.

Extremely skilled family work is obviously necessary if one is to accept the principle that schizophrenia is the product of family dynamics. Unless the handling of the family is extremely skilled one could expect, on Laing's premises, that therapy would fail and, on any assumptions at all, that a great deal of guilt and unhappiness would be brought to the members of the family. Partly to this end, Laing is much concerned to have direct involvement of all therapeutic personnel with all the family instead of the traditional format of the psychiatrist concentrating on the 'elected patient' and being fed reports by other personnel, in and out of the hospital, whilst no one has any first-hand experience of the family interacting together.

The more general observations about the ways in which the individual is formed by the family near and distant, living and dead, through example and myth, are completely absorbing. So too are the ways in which he describes the 'mapping' of our characters and personality, the ways in which our rules of thought, and the rules about rules, emerge to entangle the individual in paradoxical 'knots.' Whatever criticisms may be levelled against Laing, I do not think that triviality of material or conclusions could be among them. His analogies and use of metaphor are sometimes startling—as when he writes that families, schools and churches are the 'slaughterhouses of our children' but for the small expense involved in buying this book I would recommend anyone to get hold of a copy and enjoy the intellectual pleasures of finding out why Laing arrives at such conclusions.

B. W. P. WELLS.

LYNN, R. (1971). *An Introduction to the Study of Personality*. Basic Books in Education. London: Macmillan, pp. 108, 60p.

Perhaps books on personality have to be either 801 or 108 pages in length. The Basic Books in Education Series requires the latter approach. Quite intentionally then, Richard Lynn does not attempt to give a brief account of the many different approaches to the study of personality; rather, he treats in some detail what he regards as the most important approach. Not unexpectedly, his concern is with the now firmly established broad personality traits of anxiety (Part I) and introversion—extraversion (Part II). The areas discussed are: the measurement of the two traits (notably by questionnaire); the degree to which they are determined by heredity and environment (heredity being revealed as making a significant contribution); the physiological basis of the two traits (brief); how they vary among different groups (children of different levels of ability, individuals of different nationality, neurotics, criminals and psychopaths); and, in particular, the degree to which the two traits affect motivation and achievement in school and elsewhere.

The book is, of course, written especially for students of education. Throughout, and particularly in the final chapter, the author seeks to pinpoint the relevance of this psychological work on personality to the practical classroom situation. There is much that is thought-provoking in the views expressed on such topics as: the development of ego strength (Freud, Eysenck) in the child; the rights and wrongs of protecting children from stress; and the weakening of the traditional competitive element in school life by the abolition of streaming, examinations and prizes, and the development of the comprehensive system.

The style is direct, the chapters brief, with helpful headings and sub-headings. A useful book for students in colleges of education and for the Open University student following Course E.281, "Personality Growth and Learning." (A second edition calls for some careful proof reading. There are too many printing errors of the 'Mandsley' rather than Mandslay Hospital kind).

LORNA D. SIMPSON.

MANIS, M. (1971). *An Introduction to Cognitive Psychology*. London: Prentice-Hall, pp. 318, £4.75.

How refreshing it is to come across a psychology text which is eminently readable. In this work Manis has aimed at a particular readership, advanced university undergraduates, and he has succeeded in writing in a style which will be intelligible to them. However, ambitious but psychologically naive students on an introductory course would find it presents considerable difficulties. For this account of cognitive psychology is in no way an over-simplified one; the author has faced up to the complexity of his subject and one of the real virtues of the book is that its coverage is admirably thorough. To aid the reader to a fuller understanding of the subject Manis has provided not only an excellent exposition of the many separate topics but also critiques of a number of theories. Throughout he is at pains to reveal bridges that link the several well-mapped 'islands of information' that constitute cognitive psychology at the present time, even though the system of bridges is limited and inadequate.

Of course, in a book of this nature it would be neither possible nor desirable to provide a detailed description of all the experiments or theories which are touched upon: there are many places where the reader will have his interest whetted only to discover that to satisfy it he will have to go to primary source material. But this is no real criticism for this is an 'Introduction,' it is well documented and the bibliography is very full.

The content is organised in four main sections, 'Basic Processes,' 'Language,' 'Thought' and 'Social Cognition.' While certain topics, such as 'perception,' receive even less attention than one might expect, there are other topics, such as

'computer simulation of human problem solving,' which are given a very full treatment. This is because of the deliberate and wise policy of giving the fullest treatment to those areas of cognitive psychology which are the most recent or where the available literature is rather scanty.

The really unfortunate feature of this book is its price. Despite the fact that *An Introduction to Cognitive Psychology* is more complete, more up-to-date and better written than its predecessor, the paperback, *Cognitive Processes* (Manis, 1966), this latter book still provides much better value for money for those wishing an introductory text even if it sometimes seems like an incomplete draft version of the present work.

PETER J. MARTIN.

OSWIN, M. (1971). *The Empty Hours*. London: Allen Lane, The Penguin Press, pp. 216, £2.50.

This is a moving yet horrific book describing the empty weekend days of children whose only home is a hospital ward. The author begins with a brief survey of children's various physical and mental handicaps. There follows a very useful historical review of hospital provision, reminding us of how recently the health service has evolved from a variety of nineteenth century charities and poor law institutions. The changing function of children's hospitals is discussed and the ease with which a handicapped child can become a permanent in-patient is demonstrated. The lack of adequate local authority provision of special schools is highlighted.

Miss Oswin draws attention to the most glaring weakness of the 1948 Children's Act and of subsequent legislation in that the child in hospital does not come under the jurisdiction of the local authority and no hospital can be made to comply with the standards of child care required by the Home Office. The rest of the book describes, all too clearly, how many fail to do so.

Most of this book is a record of observations made in several hospitals and residential schools at weekends, in the absence of teachers, when the children were in the care of houseparents or nurses. The contrast between the concern for home-making and the purely physical care of these two types of institution is dramatic and shocking. First Miss Oswin describes residential schools for the handicapped which provide a model of child care and demonstrate vividly that institutionalisation is not a necessary consequence of residential care. In marked contrast, the descriptions of children in hospital wards provides a picture of serious emotional, social and intellectual deprivation: fragmentation of care, lack of any communication between staff and children, complete absence of play materials, an emphasis on ward routine, indiscriminate television, the numbering of personal possessions all contribute to a process of depersonalisation which has already been demonstrated in mental hospitals and geriatric wards.

But Miss Oswin does more than just report. She has the capacity not to turn away from situations that most of us would prefer to forget. She spent a weekend working on a ward for very severely subnormal, bedridden, incontinent, multiply-handicapped children, 'a compound of distress' in spite of the great care given to the children's physical well-being. She discusses the motivation and attitudes of the staff involved and makes the imaginative suggestion that if these children were dispersed and absorbed among less handicapped children, both they and the caring adults would benefit and learn. She also suggests that perhaps some severely subnormal adults could provide some care and love and continuity for the severely subnormal child who has to live in an institution, an idea put into practice by Dr. Gibson, at Caterham.

In the third and perhaps the weakest section of the book, the people who work in hospitals are considered: the limited training and attitudes of teachers and nurses, the role of the occupation-play therapist and the voluntary worker. The remarkable absence of any mention whatever of the medical profession or of administrators is a measure perhaps of their remoteness from life in the wards.

Their great responsibility and potential influence for change is neglected, with the exception of Dr. Gibson.

This book is essential reading for all concerned with handicapped children. While there is a wealth of well documented research available on the crippling effects of deprivation, hospitalisation and impoverished language experience this book mobilises the anger and compassion needed to bring about change.

EVA HOLMES.

PITTINGER, O. E., and GOODING, C. T. (1971). *Learning Theories in Educational Practice: An Integration of Psychological Theory and Educational Philosophy*. London: John Wiley and Sons, pp. 222, £3.50.

Textbooks in educational psychology very often fall into one of two categories. A minority are written from a particular theoretical viewpoint, and in consequence (given the current state of psychological theory) their coverage of some areas and problems is considerably less effective than that of others. The majority opt for the safer (and probably more commercial) alternative of eclecticism, adopting whatever theoretical position has shown the greatest pay-off in relation to the topic being discussed. So the author is Skinnerean on the subject of teaching machines, a Gestaltist on problem-solving, and turns phenomenological when dealing with self-concepts.

This book attempts something rather different. Four distinct theoretical positions on the psychology of learning are carefully differentiated in relation to certain key topics such as motivation and transfer. In addition, three philosophical positions relating to the goals of education are similarly analysed. Although the authors indicate that their own preference is for a phenomenological theory of learning, and a transactive philosophy, they do not attempt to convert the reader to their persuasion. Instead, by systematically exploring the combinatorial possibilities, they try to show that some philosophies and psychologies make happier bedfellows than others.

The attempt to match psychology and philosophy is the authors' main concern, and it would seem to be based on the very doubtful premise that one is free to choose either on the basis of its compatibility with the other. It is contended, for example (in this reviewer's view wrongly, but that is incidental) that an associationist theory of learning can offer little or no guidance to a teacher interested in developing creativity in his pupils, and it is implied that a teacher with such goals would do well to adopt an alternative psychological approach. This greatly underrates the importance of other criteria, such as internal consistency, testability, and compatibility with experimental results, which most psychologists would consider paramount in choosing a theory.

Not that conceptualising the issues in terms of such broad schools (both of psychology and philosophy) as the authors deal with is a particularly useful thing to do. Their 'theories' are very loosely linked bundles of ideas, and decisions to accept or reject them *in toto* cannot really be regarded as mandatory or, indeed, sensible.

The approach of analysing various positions, without attempting to influence the reader, apparently stems from the philosophical and psychological positions favoured by the authors. Actually, their neutrality is more apparent than real, since they are comparatively poor apologists for theories with which they disagree (perhaps transactive phenomenologists should confine themselves to editing books of readings?). But apart from this, the lack of controversy, and the scholastic approach make for dull reading. It is doubtful whether the book will commend itself to the trainee teachers for whom (to judge from the rather trivial illustrations) it appears to be intended. In their favour, it can be said that the authors try to be neutral, without opting for the mish-mash variety of eclecticism. My own preference is for a more empirical sort of neutrality, which allows the facts to speak for themselves.

W. B. HANTON.

SERVAIS, W., and VARGA, T. (Ed.) (1971). *Teaching School Mathematics*. A UNESCO source book. Penguin Education, pp. 308, £1.20.

This book covers a wide range of topics, is international and comparative in its outlook, the print is small but clear and the treatment (unlike that in some other UNESCO mathematics publications) is surprisingly thorough. W. Servais is at the Institut Supérieur de Pédagogie, Morlanwelz, Belgium and T. Varga is Research Officer of the National Institute of Education, Budapest. The book is in English throughout, and does for secondary teaching what the Williams' book, reviewed below, does for mathematics at the primary stage. Only a simplified and unified course, carefully based on the fundamental concepts of mathematics, can meet the present-day demands without overburdening both the timetable and the pupils. The editors have drawn on contributions from many countries of the world, including Canada, Italy, Japan, Poland, UK and USSR. These contributions reflect the different experiences and approaches being tried in curricula and methods around the world.

Initially, the nature of mathematics as a tool and an autonomous science is considered, and from this point of departure the teaching of the subject as a self-contained study, and as one with the most important practical applications, to science and everyday life, is developed. A number of prepared lessons (some as actual tape-recordings) are given and, amongst other matters, these show how modern aspects of the subject, such as sets, matrices, the calculus, probability and statistics, linear programming may be introduced. There is a good section on teaching aids, and another on the abilities and difficulties of secondary pupils who try to understand basic axiomatic concepts.

An appendix is included which gives a summary of the basic topics, which represent a common core of a modern mathematics syllabus. The bibliography is extensive and comprehensive and includes research monographs, reports, textbooks and periodicals. The publishers claim, with justification, that this is a key reference work for all those involved with mathematics teaching. It is certainly excellent value at its price!

W. L. SUMNER.

SIMON, B. (1971). *Intelligence, Psychology and Education: A Marxist Critique*. London: Lawrence and Wishart, pp. 280, £3.00.

This book is a collection of former writings by the author, beginning with *Intelligence Testing and the Comprehensive School*, first published in 1953, and a number of articles and papers which have appeared over the subsequent years.

In any old-fashioned debate on the issue of nature *versus* nurture, it is clear that the author would strongly emphasise the contribution of the environment. The contribution of a hopeful and stimulating school atmosphere to the development of children's abilities and the narrowing effects of rigid divisions of labour upon men's intellectual powers are stressed in conformity with the Marxist thesis. It is, nevertheless, arguable that such "giants in power of thought and character," to quote Engels, as Leonardo da Vinci, Michelangelo and Dürer, who certainly exemplified the merits of versatility, were exceptional cases who were capable of transcending the divisions of labour of their time to which many others must have succumbed. After all, each individual was enjoined by the much earlier parable of the talents to develop those of his abilities which were apparent and so acquire other talents in the process of optimum development; but innate individual human differences receive little mention in Professor Simon's work.

He finds much that is commendable in the Russian practice of a comprehensive school with agreed standards of attainment at different age levels, and of allowing children to attain them as determined by their individual rates of development. He does not mention the excellent schools for especially able children in mathematics

and physics, nor the concern, evident to the visitor, of many Russian parents to gain entrance for their children to the schools of high reputation in the larger towns. Defensibly, he has emphasised the illiberal aspects of streaming and of selection at 11+ in an educational system where, traditionally, one type of secondary school gave access to the universities, the professions and the higher echelons of government and he directs much of his ire at the instrument so often associated with selection in emergency situations, the so-called intelligence test. Too little acknowledgment is made of the inevitable unpreparedness of the educational organisation in the post-war years to implement the provisions of the Education Act of 1944, and the recourse to the use of intelligence tests by many harassed authorities in an attempt to avoid socio-economic inequalities. There is an apparent unfamiliarity with the statistical problems of correlation and prediction and of the sampling errors incurred in the standardisation of tests, admitted by Terman and Merrill in their 1937 revision and discussed by F. L. Goodenough (*J. Ed. Psychol.*, 1942), E. H. Ebert (*J. Psychol.*, 1941)—errors which imported variations in recorded IQ due to imperfections in the measuring instrument. G. E. Phillips, *The Constancy of the Intelligence Quotient in Sub-normal Children*, ACER, 1940, had also shown that the IQ could not be assumed to be constant and on the perennially controversial issue of racial differences in intelligence, H. G. Canady (*School and Society*, 1942, and *J. Ed. Psychol.*, 1942) had already advanced cogent arguments for regarding the alleged differences as "not proven."

The work, *Secondary School Children* (Ed. P. E. Vernon, Methuen, 1957), of which Professor Simon does not appear to approve, clearly sets out the ethical problems of selection in the preface and, as one of its final conclusions, recommended that "Psychologists should frankly acknowledge that completely accurate classification of children, either by level or type of ability, is not possible at 11 years, still less on entry to the junior school at 7, and should therefore encourage any more flexible form of organisation and grouping which gives scope for the gradual unfolding and the variability of children's abilities and interests."

Professor Simon clearly espouses a particular social philosophy and has a compatible philosophy of education. He is justified on any liberal premise in condemning any practice which admits of irrevocable decisions about a child's future; but tends to overlook the fact that the professional use of cognitive tests can further liberal aims, as in remedial education, and that lack of sameness in an educational system is conducive to ferment and freedom. It is regrettable, too, that his opposition to intelligence tests is not more consistently based upon an apparent grasp of the statistical problems involved in selection and less frequently on an *argumentum ad verecundum*.

F. V. SMITH.

SIMON, FRANCES H. (1971). *Prediction Methods in Criminology*. Home Office Research Unit Report. London: HMSO, pp. xi+233, £1.25.

This covers both a general review of prediction studies in criminology and an account of a particular study which was carried out with youths on probation. The author remarks, quite rightly, that prediction tables have been little used in administrative practice because their power is rather low. Their relative ineffectiveness is not surprising since what has to be predicted is not criminal activity but criminal conviction, and the latter involves a great ramification of chance variables involving the changing policies of local law-enforcement agencies, the accidents of the particular courts involved and many other variables irrelevant to the nature of the convicted person himself.

In penology one is tempted to reason by analogy from the educational and the clinical field. It seems reasonable to apply the same methodology as in the assessment of the relative efficiency of methods of teaching reading or of drug treatments. But Simon remarks, "... a proposal to experiment on convicted persons with different forms of treatment raises ethical questions. It is not intended to discuss

these here . . . " Her steering away from discussion of this sensitive topic seems a pity in view of her later recommendations. As research has shown that different courts award widely different penalties for identical offences, this allegedly 'ethical' objection is wearing rather thin. Leslie Wilkins, part-author of the best-known British prediction table, tried to get round the problem of the Home Office researcher operating with his hands tied behind his back by treating the variation between ex-Borstal boys as a 'natural experiment.' Although his table was immediately susceptible to cross-validation in 1951, the passage of a few years soon destroyed its usefulness. As social and economic circumstances change, even over a period of a few years, so the factors influencing the commission, detection and conviction of crime vary.

Frances Simon made use of Wilkins' work in attempting to construct a predictive instrument for young male probationers. She used the general methodology of the Mean Cost Rating as expounded by Ohlin and Duncan and others. Her 1958 sample consisted of 539 cases and she considered 62 variables of an objective nature. The 1964 sample contained 682 cases, and in studying their success rate with regard to subsequent re-conviction, she used both the objective variables and a check-list of 61 problems which was completed subjectively by the probation officer soon after he took on the case. The research rationale for this subjective instrument is unclear. As the P.O. himself was a protagonist in the interactive process which was designed to lessen the chances of future conviction, it is surely natural that his expectations about the probationer would lead to a self-fulfilling prophecy.

The best predictive table derived from the 1958 sample (Mean Cost Rating = .26) depended wholly on the history of the probationers' past convictions. When applied to the 1964 sample it proved virtually useless as the M.C.R. shrank to .14. The best predictive index for this latter sample was the P.O.'s feeling that his client had 'delinquent tendencies'—this selected from the 61 item check-list. The Home Office mountain of research had groaned and produced this mouse.

This is not an easy book to follow. It represents the fruit of an enormous amount of work by a large number of people over quite a period of time. Its style of presentation leaves something of a confusion in the reader's mind. Results, discussion of these data and of other people's data are often mixed together. One gets the feeling that the writer has lived with her material for so long that she has forgotten that other people are not as familiar with it as she is. As far as one can gather, the exercise was a resounding failure as far as prediction went, but the reader would need to do a very detailed post-mortem study to make up his mind *why* it was such a failure. A statistician might question the use made of regression analysis with dichotomous variables; a psychologist might wonder about the sort of use that was made of P.O.s as raters, and a social theorist might question the usefulness of the whole operation. In the author's final conclusions she argues that as we have failed to find any effective means of predicting success on probation, we should abandon such predictive research and turn to studying better means of treatment. This brings us back to the dilemma which faces all research workers in penology—the impossibility of doing controlled experimental work owing to the opposition of the administration. As long as the Home Office will sponsor research only with such limitations in this field, it is unlikely that we will get other than negative studies.

H. B. GIBSON.

VERNON, M. D. (1971). *Reading and Its Difficulties*. Cambridge: University Press, pp. 211, £3.20.

This book presents a scientific enquiry into the psychological basis of reading and into dyslexia. Vernon has undertaken the mammoth task of reviewing over 500 pieces of research in the field of reading and in so doing has confined herself to the basic psychological processes involved in learning to read. An outline is given of recent work in psycholinguistics in so far as this appears to be relevant to reading and the effect of emotional and motivational factors in learning to read is also considered. A major part of the book is devoted to specific developmental dyslexia.

In her foreword Vernon highlights the problems facing someone reporting research in reading. There are on the one hand the opinions of experienced teachers which often lack "verification by means of controlled observation and investigation" and which lead to disagreement on almost every aspect of reading, and there is, on the other hand, the inadequacy of the experimental design and performance of much of what passes for hard research. It takes immense knowledge and expertise to sort out this field of research and as in her previous publication, *Backwardness in Reading* Professor Vernon shows herself an expert in presenting a critical review of the massive amount of research done on reading. The chapters in the present work on visual perception, auditory and linguistic factors, reasoning and intelligence and motivational and emotional factors are all excellent reviews with balanced conclusions, e.g., "It is obvious that there is much variation between the findings of different experiments as to the relation of linguistic processes to reading achievement," and "It cannot be said that reading backwardness is wholly or necessarily associated with any particular cognitive or motivational defect . . ."

It is, however, on the chapter on specific developmental dyslexia that Professor Vernon makes an outstanding contribution. The careful analysis of the nature of specific developmental dyslexia, visual deficiencies in dyslexia, linguistic deficiencies in dyslexia, the causes of dyslexia under three headings ('neurological impairment, maturational lag and hereditary factors'), and a concluding section on the effects of remedial treatment all add up to a much needed independent review.

This is an important book which should be essential reading for all concerned with the reading process.

ALASTAIR MILNE.

WILLIAMS, J. D. (1971). *Teaching Technique in Primary Maths*. London: NFER, Exploring Education Series, pp. 108, 75p.

A great deal has been compressed into this little paperback. It is an illuminating account by a professional research worker of the issues involved in mathematics learning at an early age, and of some up-to-date research findings which bear upon these issues.

The author was for several years head of the Foundation's section for mathematical and conceptual studies, and is now working with Z.P. Dienes at the Centre de Recherches en Psycho-Mathématique in Quebec. The book, illustrated with figure drawings and colour plates, describes the uses of the structured materials associated with such names as Stern, Cuisenaire, Dienes, Kern, Shaw and Jones, and of modern counting frames and desk calculators. A summary of evaluative research on the various approaches stresses the importance of using a combination of techniques in the classroom.

Recent experiments with desk calculators suggest how an initial grounding may be obtained for later work on computer techniques.

Research into programmed instruction has shown that it is frequently as effective as, and sometimes better than, human instruction, although the author underlines that programmed instruction, films and television are there simply to free the teacher to use his more flexible talents, and relieve him of routine work. More than most school subjects, mathematics certainly lends itself to programming and can benefit from this mode of presentation.

The central core of the book is valuable discussion of methods of teaching for the understanding of mathematics and of introducing concrete experience, feed-back, self-pacing and discovery learning.

A discussion of the work of Piaget (which might have been more critical), and that of Dienes leads to their impact on the approaches to mathematics teaching. Nevertheless, there is a timely reminder to teachers not to accept too many new techniques at their face value, but rather to draw up more detailed blueprints of teaching objectives before they put their favourite methods into operation.

W. L. SUMNER.

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CHILDREN'S ROAD BEHAVIOUR AND PERSONALITY

By HELEN M. FINLAYSON

(Department of Psychology, University of Southampton)

SUMMARY. 198 children age 5 to 10, from two schools, were filmed on seven days out of a period of two weeks, as they crossed the road at particular sites at the end of each school day. Their behaviour on approaching and crossing the road was analysed from the films and they were classified accordingly into three behaviour groups. Most of the children over 7 years old then completed ESPQ and CPQ personality questionnaires in school.

The three behaviour groups were 'safe,' 'careless' and 'unsafe.' The 'unsafe' tended to act unpredictably, typically running down the path and into the road without stopping. These were almost all boys. The 'careless' would not look round before crossing the road, but would just walk across in a predictable manner.

The three groups of boys were found to be significantly different in personality, when the whole profiles were compared. The analysis of boys and girls together from one school also showed different personality profiles in the three behaviour groups.

INTRODUCTION

For some time research has been undertaken into the factors which affect the likelihood of children having road accidents. Much of the research has been into the background factors of the child's environment, which are now fairly well documented (Backett and Johnston, 1959). Other researchers have considered the relationship between personality traits and accident liability, and the results of this work have not always been consistent. Some differences may have resulted from the use of different criteria on which the subject groups were defined, and different measures used for the personality traits. Most often comparisons were made between 'accident children,' defined as those who have been involved in at least two accidents of the type being investigated, and 'non-accident children,' who have not been in any accidents that required medical attention. In such an investigation no account can be taken of the possible effects of the accident on the child, and this is an obvious drawback on all research done after the event.

One general conclusion which comes out of this research is that 'accident children,' as previously defined, tend to be more active and aggressive than 'non-accident children' (Krall, 1953); Marcus *et al.* (1965) hypothesise that 'accident children' act out their tensions and frustrations; Salwer (1967) suggests that 'accident children' tend to be inept in their motor behaviour and are particularly vulnerable when in an anxiety arousing situation.

Manheimer and Mellinger (1967) put forward an 'exposure-coping' model of accident liability among children, based on their finding in a large scale study of 'accident repeaters' and 'non-accident' children, where accidents of all kinds were considered. Under this model the personality factors which affect the likelihood of a child having an accident are divided into two groups:

- (1) Exposure: those factors which tend to increase the child's exposure to hazards;
- (2) Coping: those factors which relate to the way a child may respond in a hazardous situation.

A child's exposure to risk is partly determined by his physical environment and partly by his own choice of behaviour within that environment. Manheimer and Mellinger considered the characteristics such as extraversion, curiosity and activity level to be related to exposure to hazard, and so to accident liability. The response a child is likely to make in a hazardous situation also affects his accident liability and such traits as attention-seeking and daydreaming are considered likely to impair a child's coping ability.

All these studies hypothesising a correlation between the liability to have accidents and personality assume that behaviour is a related variable. In the case of road accidents the hypothesis is that personality affects behaviour on the road, which contributes to an accident. Since a relationship between personality and accident liability has been demonstrated in previous research, it may be possible to find a similar relation between road behaviour and personality.

Very little research has been done on children's road behaviour. Heimstra, Nichols and Martin (1968) considered a methodology for the analysis of child pedestrian behaviour, scoring both the approach to the kerb and the crossing. Sandels (1970) observed the behaviour of children travelling to and from school for a month, and rated their road crossing as good, average or bad on each occasion. She concluded that girls behaved better than boys, that there was no significant difference in performance between 4- and 7-year-olds, and that in general children were inconsistent in their behaviour. The rating system used by Sandels is not known, and only the age and sex of each child appears to have been considered in the investigation. No other studies appear to have been done relating observed road behaviour to personality. Most observations have produced only general statements about the behaviour of boys compared with girls, or of different age groups, and much potential information has been lost in this way.

This study was set up primarily to observe and analyse children's road behaviour at one particular site where the same children could be observed each day. The second purpose was to investigate the relationship between observed behaviour and personality of these children.

METHOD

In this study of children's road behaviour it was decided to take children of the ages at which most accidents occur, which is between 5 and 7 years, and to look at road behaviour on minor roads where, it is suggested, a high level of skill in making judgments is not required but where a considerable number of accidents to young children occur. Primary school children were, therefore, the subjects, and their behaviour was observed and filmed as they came out of school at the end of each day. Children from two schools were used. One was a primary school taking children from 5 to 11 years, and the other was a first school covering the age range of 5 to 8 years. For each school one particular crossing site was found at which the filming was done, from a hidden position.

The sites were chosen to fulfil the following criteria: (a) close to the school where there were a lot of children crossing each day; (b) at some sort of junction; (c) where the traffic flow was not sufficient to warrant the use of traffic wardens, but not so light as to allow children to play in the road. The subjects used were all the children under the age of 11 years who were observed crossing the road at least once and were recorded on the films and identified by the staff of the school.

The background of the children from school A was considered by the headmaster to be fairly homogeneous skilled and unskilled working-class. School B had a more varied intake; some children were from skilled and unskilled working backgrounds, but more perhaps were from clerical and professional and managerial backgrounds, as the catchment area for the school included a popular middle-class residential area. No indicator of socio-economic group was obtained for the individual children.

Cattell's personality tests were used to measure the personality factors of the children. The Early School Personality Questionnaire (ESPQ) was used for the 5- to 8-year-olds, and the Children's Personality Questionnaire (CPQ) was used for the 9- and 10-year-olds. These questionnaires are designed to give ratings on the same 13 bi-polar factors, and are meant to be used together to span the 5- to 10-year-old age range.

The filming was done using a Bolex reflex 16 mm. cine camera, with colour film. As there was no motor attachment to the camera, the film had to be wound after every 20 seconds filming. This meant that it was not possible to film continuously, but sequences of behaviour had to be selected. Thus, some observations were necessarily lost.

The study was carried out in two parts, first on school A, and then on school B. The procedure in each case was approximately the same, though some slight modifications were made for the second school, after the experience of the first. In each case the site was chosen, and then the co-operation of the head teacher and access to a suitable observation point were obtained. The children were filmed on several days, as they left school at the end of the day. Seven films were made at school A, each on a different day, and nine were made at school B. The films were shown to the head teacher and staff of the school, and each child was identified as he appeared on the film. The older children identified in this way then completed personality questionnaires in school.

The behaviour of the children as they appeared on the film was written down, following the suggestions of Heimstra *et al.* (1968). The approach and crossing behaviour of each child were noted separately. The following details were recorded:

Approach: speed of approach, group behaviour, looking behaviour, anything unusual, playing, etc.

Crossing: stop or change in speed, group behaviour, looking behaviour, position of crossing, traffic situation, anything unusual.

In the film analysis a crossing was said to be in traffic if there was a moving vehicle anywhere near the junction at the time of the approach or crossing, even if it was not on the road which was being crossed.

On the basis of these descriptions each child was classified into one of the three main behavioural groups, and the personality profiles of the three groups were compared.

RESULTS

Road behaviour.

198 children were observed crossing the road a total of 405 times. 97 of these children were seen only once and 50 of them were seen three or more times, some appearing as many as eight times.

The crossing behaviour from all 405 observations was analysed for age and sex differences, and for differences in the traffic conditions and in group or

individual behaviour. The elements of behaviour which were considered in this analysis were: (a) whether the child ran or walked across the road; (b) whether he stopped at the kerb before crossing; (c) whether he looked both ways before crossing the road.

Because there were physical differences in the crossing sites the analysis was carried out separately for the two schools. Table 1 gives the frequency of observed behaviour. χ^2 tests were used to compare the behaviour differences and those marked with an asterisk were all significant at the .05 level.

TABLE 1
FREQUENCY OF OBSERVED BEHAVIOUR IN CROSSING ROAD.

	SCHOOL A 174 observations				SCHOOL B 231 observations			
Sex Differences:	Boys		Girls		Boys		Girls	
(a) Run	39		35		66		114	
Walk	42		58		15		36	
(b) Stop	40		54		51		138*	
Not Stop	41		39		30		12	
(c) Look	45		55		61		111	
Not Look	36		38		20		39	
Age Differences:	5+6	7	8	9+	5+6	7	8	
(a) Run	26	20	22	6*	17	16	18	
Walk	22	20	28	30	78	62	40	
(b) Stop	30	21	31	12*	79	65	45	
Not Stop	18	19	19	24	16	13	13	
(c) Look	25	25	36	14*	69	59	44	
Not Look	23	15	14	22	26	19	14	
Traffic Differences:	Traffic		No Traffic		Traffic		No Traffic	
(a) Run	27		47		62		118	
Walk	46		54		22		29	
(b) Stop	50		44*		81		108*	
Not Stop	23		57		3		39	
(c) Look	51		49*		69		103*	
Not Look	22		52		15		44	
Group v. Individual:	Group		Own		Group		Own	
(a) Run	26		48*		107		73	
Walk	57		43		37		14	
(b) Stop	43		51		116		73	
Not Stop	40		40		28		14	
(c) Look	45		55		104		68	
Not Look	38		36		40		19	

* $P < .05$

Sex differences. In school B girls stopped at the kerb more frequently than the boys.

Age differences. Older children ran across the road less frequently than younger children; this change particularly occurred at the age of 8 years. In school A where the age of subjects went up to 10 years, age differences were observed in stopping and looking behaviour. Up to the age of 8 the proportion of children stopping and looking gradually increased, but at 9 and 10 a reversal of this trend occurs.

Effect of traffic. In both schools more children stopped when there was traffic near the junction than when there was no traffic, and more children looked both ways in traffic than in no traffic. There was also a tendency for children to walk across the road rather than run when there had been or was traffic around. These differences in behaviour in traffic and in no traffic were also noted within subjects. The same child seen on two different occasions would look round in traffic, but not look when there was no traffic.

Group versus individual road crossing. Children were seen to run across the road more frequently when they were alone than when they were in groups with other children.

Classification of road behaviour.

The criterion initially used to classify road behaviour was based on a simple safe/unsafe dichotomy, where the conditions for safe behaviour were considered to be :

- (i) Look in all directions for oncoming traffic.
- (ii) Avoid doing anything which could not be anticipated by a driver, e.g., running out without stopping.

On examination of the films, it was discovered that these two criteria were quite separate, and some children failed only on the first condition, while others failed only on the second. Thus, three behavioural groups were defined :

- (1) Safe : those who fulfilled both of the above conditions.
- (2) Careless : those who failed in the first condition only, i.e., neglected to look all round before crossing, but otherwise behaved in a fairly predictable manner.
- (3) Unsafe : those who behaved unpredictably doing things which could not be anticipated by a driver, that is failing in the second condition.

For the actual classification of subjects who had been seen several times, the following criteria were applied:

Safe : a child was classified as safe if in at least two-thirds of his road crossings he looked in all necessary directions for traffic and crossed the road attentively, and at other times never ran out into the road, or otherwise acted in a dangerous manner.

Careless : a child was careless if he did not look in both directions before crossing the road, in a third or more of the observations, but did not run out into the road or act unpredictably.

Unsafe : an unsafe child was one who at any time was seen acting unpredictably when crossing the road. Most of the children in this group ran out into the road without looking, ran out from between parked cars, or were playing or fighting with someone else as they crossed the road.

On the basis of these criteria 182 out of the total of 198 children were classified giving the following numbers in each group :

Boys :	42 safe	28 careless	23 unsafe
Girls :	45 safe	35 careless	9 unsafe

16 children were omitted from this classification because they were never seen alone. Each of them was only seen when he was accompanied by another child, usually an older sibling, who conducted him across the road.

With a few exceptions only the children aged 7 or over were asked to complete the personality questionnaires as it was considered by the staff of the schools to be too difficult for most of the younger ones. 134 out of the 182 were then classified into behaviour groups and assessed on personality.

Boys : 29 safe 16 careless 18 unsafe

Girls : 39 safe 25 careless 7 unsafe

Personality.

The children in the three behaviour groups of 'safe,' 'careless' and 'unsafe' were compared on personality, using one-way analysis of variance, and multiple group discriminant analysis. The latter was used to compare the personality profiles of the three groups. The computer programme which carries out this analysis produces a measure of the discrimination between the groups and calculates the significance of this discrimination; it also picks out the personality factors which are most important in differentiating between the groups.

Since this analysis compares the pattern of all 13 personality factors simultaneously, its results were considered to be more meaningful than those of the one-way analysis of variance which is capable only of comparing one personality factor at a time (Cooley and Lohnes, 1962).

The analysis was done separately for boys and for girls, and also for school A and school B. The significance levels for the discrimination analysis and analysis of variance were taken at the .05 level.

In the all-boys analysis the three behavioural groups were found to be significantly different in personality profiles. The factors which were important in separating the groups are given in Table 2, together with the group means and standard deviations.

TABLE 2

MEAN PERSONALITY SCORES FOR SAFE, CARELESS AND UNSAFE GROUPS.
(Boys only : Standard Deviations in Parentheses.)

Factor Low Score	Safe	Careless	Unsafe	High Score
E Submissive ..	5.14 (1.77)	6.44 (1.15)	4.33 (1.65)	Assertive.
O Placid	5.21 (2.64)	5.38 (2.80)	5.22 (2.07)	Apprehensive.
D Phlegmatic ..	4.72 (2.53)	6.00 (3.10)	5.50 (2.66)	Excitable.
Q Relaxed	6.48 (2.34)	7.19 (1.68)	7.61 (1.46)	Tense.
G Expedient ..	4.00 (2.39)	5.19 (2.17)	3.61 (1.76)	Conscientious.
N	29	16	18	

Factors E and O were also significant in the one-way analysis of variance. Both the unsafe and careless boys were more excitable and demanding (D) and tense and frustrated (Q) than the safe ones. The careless were also more dominant and assertive (E) and more conscientious (G) than the safe, whereas the unsafe were more mild and submissive (E) and more expedient (G).

The analysis of boys and girls together in school B also gave significant results. Three of the factors indicated in this analysis as contributing to the discrimination were the same as for the boys, but factor I was indicated in addition.

TABLE 3

MEAN PERSONALITY SCORES OF SAFE, CARELESS AND UNSAFE GROUPS.

(School B: Standard Deviations in Parentheses).

Factor Low Score	Safe	Careless	Unsafe	High Score
I Tough-minded	4.16 (2.24)	5.56 (1.81)	1.67 (1.00)	Tender-minded.
E Submissive ..	4.97 (2.68)	4.74 (1.89)	4.44 (1.24)	Assertive.
G Expedient ..	4.72 (2.35)	6.17 (2.17)	3.44 (1.81)	Conscientious.
O Placid	5.66 (1.98)	5.61 (3.10)	5.33 (2.78)	Apprehensive.
N	32	23	9	

Factors I and G were significant in the analysis of variance. The unsafe were found to be more self-reliant and tough-minded than the safe and careless, while at the same time appearing mild and submissive.

The analysis for all girls and for school A did not give significant results.

DISCUSSION

In agreement with Sandel's findings, boys and girls were seen to behave differently on the road. The difference was most obvious when the criteria for classification of behaviour were applied. More boys than girls acted unpredictably and were classified as 'unsafe.'

Age differences were also found in road behaviour, and this does not seem consistent with Sandel's finding. Both running and looking behaviour alter with age, and although 8 years seems to be the age of greatest change, the change does not occur suddenly.

A difference was found in behaviour, apparently due to the traffic conditions, suggesting that some children may be consciously or unconsciously using hearing to detect traffic. This difference may have contributed to the impression of inconsistent behaviour gained by Sandels in the Swedish study. In this study the children seen on repeated occasions who were classified as 'safe' or 'careless' were considered to be reasonably consistent in their road crossing behaviour, but inconsistency was typical of the 'unsafe' child.

Differences in the personality profiles of the 'safe,' 'careless' and 'unsafe' groups of subjects were found for all boys and for all subjects from the second school. The personality factors contributing to the discrimination indicate that both the careless and unsafe are more excitable and tense than the safe, which is in agreement with previous findings from studies of accident repeaters. The careless and unsafe, however, are different from each other on other factors. These suggest that the careless are responsible, but over-confident, whereas the unsafe appear submissive and obedient, but are expedient and likely to evade rules. These two groups are different in the manner in which they are unsafe, and they also appear to be different in their underlying personalities,

The difference in means of personality factors for the three behaviour groups is very small and too much emphasis should not be put on the individual factors. The important point about these results is that the existence of three, clearly defined behavioural groups is supported by significant personality differences between the groups.

ACKNOWLEDGMENT—This research was sponsored by the Department of the Environment, Road Research Laboratory.

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(Manuscript received 24th November, 1971)

AGE OF TRANSFER TO SECONDARY EDUCATION: A POSTSCRIPT

By J. D. NISBET, JENNIFER WELSH and N. J. ENTWISTLE

(*Department of Education, University of Aberdeen, and Department of Educational Research, University of Lancaster*)

SUMMARY. Of the year-group of 2,900 Aberdeen children who had been the subjects of a study on the age of transfer to secondary education, about one quarter went on to the fifth and sixth years of secondary education, and their careers were examined. The best prediction of final secondary school performance was given by assessments of attainment in the first two years of secondary school; next in order were verbal reasoning tests at ages 11, 12 and 13, with little difference among these; next, a verbal reasoning test at age 9; and, poorest, non-verbal tests at ages 11 and 7. Correlations between tests and criterion were higher for girls than for boys; but measures of academic motivation showed higher correlation with performance among boys than among girls. Social class differences in the proportions of pupils staying on to fifth year, were greater for girls than for boys. Relatively few pupils with low scores in primary school tests achieved success in Scottish Certificate of Education examinations, and most of those with high scores who remained at school were very successful; but there were some exceptions which demonstrated the fallibility of early assessments in individual cases.

INTRODUCTION

IN 1963 the Scottish Council for Research in Education commissioned a research project on the age of transfer to secondary education (which is a year later in Scotland than in England). The results were published in two reports, *The Age of Transfer to Secondary Education* and *The Transition to Secondary Education* (Nisbet and Entwistle, 1966, 1969). The conclusion from the first report was that wide individual differences in the rate of children's physical, intellectual, social and emotional development make it impossible to choose any one year as a 'correct' age for transfer: the final years of primary school and the first years of secondary school should be regarded as a transitional period, during which there is a gradual change in curriculum and style of teaching. The second report reviewed the progress of an age-group of children over the last two years of primary school and the first two years of secondary school. The results demonstrated the influence of social class, motivation and parental encouragement on children's adjustment to transfer. For accurate prediction of secondary school performance, there was little to choose between the assessments at age 11 and age 12: actual performance in the first year of secondary school gave clearly the best forecast of performance up to the end of the research project.

However, the research project ended when the children completed their second year in secondary school at age 14. Although this was an appropriate point to conclude a study of the transitional period, it provided only a rough measure of success in secondary school and it was clearly desirable to extend the study until the children had all left school, so that the earlier results might be checked against a longer-term criterion. In 1971, when the last of the group completed their sixth year of secondary school, the Scottish Council for Research in Education gave an additional grant for the clerical work involved in tracing the subsequent school careers of the sample. The existing data included test

scores from age 7 for this year-group. In the Scottish system, pupils sit the Ordinary Grade of the Scottish Certificate of Education (SCE) in the fourth year of secondary school (about age 16), and the Higher Grade of SCE in the fifth or sixth year (or in both fifth and sixth). The additional data collected in this extension of the follow-up of the age-group of pupils, provided (i) a check on the validity of the assessment at age 14 as a criterion of secondary school performance; and (ii) further information on the predictive value of primary school assessments and on social class factors in secondary education.

ASSESSMENTS AND SAMPLES

A detailed account of the various measures used is given in the 1969 report (Chapter 4). The assessments referred to in this report are:

Intellectual measures.

- NVR 7 Moray House Picture Intelligence Test 1, at age 7.
- VR 9 Schonell Essential Intelligence Test, Form B, at age 9.
- R 10 NFER Sentence Reading Test 1, at age 10.
- NVR 11 NFER Non-Verbal Reasoning Test 1, at age 11.
- VR 11 Moray House Verbal Reasoning Test 68, at age 11.
- VR 12 Moray House Verbal Reasoning Test 72, at age 12.
- VR 13 Moray House Advanced Verbal Reasoning Test 12, at age 13.

Non-intellectual measures.

- Q 13, Q 14 Score on academic motivation inventory, at ages 13 and 14.
- JEPI E13, Extraversion and neuroticism scores on Junior Eysenck N 13 Personality Inventory, at age 13.
- EPI E, N Extraversion and neuroticism scores on Eysenck Personality Inventory, Form A, at age 16.

Criterion measures.

- Crit 13 Teachers' ranking of pupils in all academic subjects, scaled by classes on VR13 and combined to form a criterion of performance at the end of first year of secondary school.
- Crit 14 Teachers' ranking of pupils in all academic subjects, scaled by classes on Moray House Advanced Reasoning Test 9 (applied at age 14) and combined to form a criterion of performance at the end of second year of secondary school.
- O-Grade Number of Ordinary Grade passes in the Scottish Certificate of Education at the end of fourth year of secondary school.
- H-Grade Number of Higher Grade passes in SCE at the end of fifth year of secondary school.
- SCE score A final composite criterion of SCE performance, following the procedure adopted by McIntosh (1959, p. 44): a weighted addition of marks at both H- and O-grades, H-grade marks receiving double weight, O-grades omitted where a subject was taken at both O- and H-grade.

The initial group in the main project had been defined as "those children who were expected to transfer to secondary school in either January or August, 1965, and for whom complete test results were obtained in April, 1964." This was virtually a complete year-group within the City of Aberdeen. (A county

sample was also studied, but is not included in the present follow-up.) There were two levels of coverage in the 1969 report :

- Group A : all those for whom complete data on intellectual measures from age 11 to age 14 were available. $N=2902$ (1,478 boys, 1,424 girls)
- Group B : those in Group A for whom complete data on all intellectual and non-intellectual measures were available. $N=2,538$ (1,293 boys, 1,245 girls)

After the end of the second year of secondary school, the next contact with the group was at the end of the fourth year, when the results of SCE Ordinary (O) grade were recorded. Two of the six largest schools in Aberdeen applied the policy of encouraging pupils to bypass O-grade examinations if they were likely to go on to the Higher (H) grade. In using O-grade results, therefore, it was necessary to exclude all pupils from these two schools. The total number of pupils from the original group (excluding these two schools) who were still at school during the fourth year was 1,177 (600 boys, 577 girls), of whom 282 (129 boys, 153 girls) had no O-grade passes, and 98 (31 boys, 67 girls) had missed one or more of the earlier assessments. Group O was, therefore, defined as :

- Group O : those who had O-grade SCE passes and for whom complete data on all intellectual and non-intellectual measures were available (excluding pupils from the two schools). $N=797$ (440 boys, 357 girls)

At the end of fifth year, results of H-grade SCE examinations were recorded for all schools. The total number of pupils from the original group still at school during the fifth year was 1,453 (722 boys, 731 girls), of whom 674 (326 boys, 348 girls) gained no H-grade passes at the end of that year, and 129 (53 boys, 76 girls) had missed one or more of the earlier assessments. Group H was, therefore defined as :

- Group H : those who had H-grade SCE passes at the end of the fifth year and for whom complete data on all intellectual and non-intellectual measures were available. $N=650$ (343 boys, 307 girls)

Finally, during the sixth year, pupils sat additional examinations at H-grade and O-grade. These additional results were noted separately in the records of Sample H.

RESULTS

The first stage in the analysis of the data was to compare the previously published findings based on performance at the end of second year (Criterion 14) with those got from the extended follow-up to fifth and sixth years (O-grade H-grade and SCE score). Table 1 presents three sets of results :

- Column 1 : The original correlations with Criterion 14 for the full Group A (or the slightly reduced Group B).
- Columns 2 and 3 : The same correlations with Criterion 14, attenuated by the restriction in range of Groups O and H.
- Columns 4, 5 and 6 : The new correlations with the later criteria, for Groups O and H.

The intermediate set of attenuated correlations with Criterion 14 (restricted groups) provides the necessary basis for comparison of the third set (later criteria, restricted groups) and the first set (Criterion 14, full group).

TABLE 1

CORRELATIONS OF ASSESSMENTS FROM AGE 7 TO 13 WITH PERFORMANCE IN SECONDARY SCHOOL.

Test	Correlation with Criterion 14						Correlation with later criteria :					
	Group A or B N 2902 or 2538		Group O N 797		Group H N 650		O grade		H grade		SCE score	
							Group O		Group H		Group H	
	B	G	B	G	B	G	B	G	B	G	B	G
NVR 7	66		35	39	24	36	35	31	28	27	24	29
VR 9	78		52	48	36	49	47	40	38	39	32	41
R 10	69		44	38	34	36	35	28	26	30	23	31
NVR 11	66	70	37	37	26	31	37	38	26	32	27	33
VR 11	82	83	62	58	53	57	46	48	47	50	42	53
VR 12	84	84	62	56	51	52	49	51	41	49	40	45
VR 13		84	59	60	47	54	50	52	44	47	41	47
Crit 13	91	92	77	81	72	83	68	70	64	65	58	71
Crit 14	—	—	—	—	—	—	70	73	65	70	61	76
Q 13	50	42	29	20	24	22	24	16	22	15	25	21
Q 14	48	43	25	08	19	16	23	10	21	09	26	14
JEPI E	-01	05	-04	-15	-05	-01	-08	-16	-10	-07	-17	-01
JEPI N	-15	-20	-09	-11	-05	-08	-06	-12	-06	-09	00	-12
*EPI E	—	—	—	—	—	—	-20	-24	-21	-09	-23	-20
EPI N	—	—	—	—	—	—	-09	-02	03	-01	02	-04

Decimal points omitted.

*N=709 for Group O and 592 for Group H.

The correlations set out in Table 1 show that the extension of the follow-up to the end of secondary school has not resulted in any alterations to the provisional conclusions based on performance to the end of second year of secondary school. The main findings are :

- (i) The best prediction of final secondary school performance is given by assessment of actual performance in the early years of secondary school (Criterion 14, Criterion 13). This is now a well-established finding in prediction studies.
- (ii) Among the verbal reasoning tests at ages 11, 12 and 13, there is little difference in correlation with subsequent performance. There is no evidence here that any one of these ages is better than any other for a general ability assessment.
- (iii) The verbal reasoning test at age 9 comes next in predictive accuracy, clearly superior to the non-verbal tests at 7 and 11 and to the short reading test at age 10.
- (iv) Correlations involving intellectual measures tend to be higher for girls than for boys. Group O, in which most of the exceptions occur, is unsuited for comparisons of this kind : schools which ' by-passed ' O-grade examinations were excluded from Group O, and the largest of the three girls' schools in the city was omitted for this reason. By contrast, the correlations involving academic motivation (Q 13, Q 14) are lower for girls. (Not all the differences are significant, but all are in the same direction.) The school performance of girls is thus more predictable from intellectual measures ;

with boys, it would appear that motivation (or lack of it) plays a more important part in success, or the scale discriminated more effectively among boys.

Table 2 sets out the distribution of social class in the original Group A and in Group H, the pupils who stayed on at school to fifth year. Columns 5 and 6, in which Group H is expressed as a proportion of Group A, give an approximate indication of the differential drop-out by social class. (The figures are not precise because of the effect of migration, but migration is more frequent in non-manual families than in the manual group.) The social class gradient is more marked for girls: proportionately more girls than boys from Social Class I and II stay on, and fewer girls from Social Classes III, IV and V. It is of interest, however, that Group H contains a larger *number* of pupils from the manual categories (183 boys, 159 girls) than from the non-manual (153 boys, 143 girls).

TABLE 2

PUPILS STAYING TO FIFTH YEAR OF SECONDARY SCHOOL, BY SOCIAL CLASS.

Social Class	Group A : entered secondary school		Group H : stayed to fifth year year		H as % of A		Group H : Mean VR12	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
I	39	23	27	18	69	78	114.8	116.2
II	150	137	68	70	45	51	114.4	118.0
III non-manual	174	200	58	55	33	28	114.4	114.6
III manual	629	528	142	127	23	24	113.6	115.1
IV	162	193	24	18	15	9	114.3	114.0
V	139	164	17	14	12	9	112.0	117.4
Not known	185	179	7	5				
Total	1478	1424	343	307				

The final columns in Table 2 give the mean scores in VR12, by social class, for those who stayed on to fifth year. The absence of any social class gradient in these mean scores suggests that staying on at school is a function of ability rather than of social class. Social factors may operate indirectly on ability as measured by VR12, but there is no evidence that less able pupils from Social Classes I and II tend to stay on or that only the very able pupils from Social Classes IV and V stay on at school.

Many of the pupils from Social Classes IV and V do not stay on at school because they are relatively unsuccessful in academic work. It is of special interest therefore to examine the records of performance of those pupils from Social Classes IV and V who did stay on to fifth year. There were 73 such pupils of whom 37 had obtained only one SCE pass or no passes by the end of fifth year. Extending the follow-up to the end of sixth year identified a group of 18 pupils (11 boys, 7 girls) from these 73 who gained five or more Higher passes. Inspection of their early assessments showed that they had almost uniformly high scores in verbal reasoning tests from age 9 on, and high scores on the academic motivation questionnaire. For example, three pupils from this group who obtained seven Higher passes have verbal reasoning scores, at age 9, of 140+, 130+ and 115, respectively; in the verbal reasoning tests at 11, 12, 13 and 14, one scored

consistently over 130, and the other two had only one score below 120 ; and on the motivation questionnaire which was applied at ages 13 and 14, all scores were in the highest three categories of the nine-point scale.

Were there many able pupils from Social Classes IV and V who did not stay on at school? When the scores in VR12 were examined for all those from Social Classes IV and V who left school before the O-grade examinations, only three were found with scores over 120, and none of these was over 130. Two of these three pupils had high motivation scores (Q13), and one had a low score. Although there is thus no evidence of wastage among those of the highest ability, there may still be a more general loss (and, in numbers, more substantial) at lower levels of ability.

However, the follow-up also discovered a number of pupils entering for SCE Higher grade examinations, who had obtained low scores in the verbal reasoning test in the transfer examination before entry to secondary school. There were 32 pupils (21 boys, 11 girls) whose scores in the verbal reasoning test at age 12 were below 100, and who yet survived to fifth year of secondary school. But 23 of these gained only one pass or no passes in fifth year, 7 gained two passes, one gained three, and one gained five Higher passes. The last mentioned is the one firm example of serious failure of the tests to predict success : he scored between 95 and 99 in all four verbal reasoning tests at ages 11, 12, 13 and 14 ; but his motivation score was in the highest category of the nine-point scale at both 13 and 14. Among these 32 pupils, motivation scores were above average, but they extended over the whole range from high to low. The social class distribution in this group was not significantly different from that of the total Group H. A chi-square test showed that the actual numbers were close to the expected numbers for Social Classes I, II and IIIa ; there were proportionately more from III manual ; and there were slightly fewer from IV and V. In case the VR12 score had been inaccurate for any of these 32 pupils their VR11 and VR13 scores were also checked : only two of these 64 scores were above 109, and these were not two scores for the same pupil.

Another group of pupils whose individual scores were examined was the group who had consistently high scores in the assessments made while they were in primary school. 'Consistently high score' was defined as : verbal reasoning scores at 9, 11 and 12 all over 120, and an average score over 120 in the transfer examination at age 12 (verbal reasoning, English and Arithmetic). There were 101 such pupils (44 boys, 57 girls) in the combined O and H groups. By the end of their fifth year, 77 of these had already gained sufficient SCE passes to qualify for university entrance, and 39 had gained five or more Higher passes. Among those who left school before the O-grade examinations, there were only 11 who had 'consistently high scores.'

A parallel study of very able pupils was made by identifying those pupils whose final SCE score was particularly high (over 90 on McIntosh's scale, which takes account of the mark obtained as well as the number of passes), and tracing back to examine their primary school assessments. There were 69 of these 'high fliers' (41 boys, 28 girls). Of these, 8 had an average score below 115 in the transfer examination at age 12. If a score of 115 in a verbal reasoning test at age 11 had been adopted as a minimum requirement for a course of study leading to SCE, 13 of this group would have been excluded. A similar requirement at age 12 would also have excluded 13. The fact that these pupils did get their chance is at least some evidence of flexibility in the selection system.

In general, however, the main trend of the results is to confirm the validity of early assessments, and it is perhaps disappointing that there are relatively few examples of pupils whose subsequent success contradicted earlier predictions. There were sufficient exceptions to the general rule to demonstrate that no selection system is infallible, and the follow-up did not tell us about pupils who left at age 15, nor about what might have happened if this inquiry had been made after instead of before comprehensive reorganisation.

ACKNOWLEDGMENT—Thanks are due to the Scottish Council for Research in Education for the grant in aid of this investigation; and to the head teachers of the secondary schools in the City of Aberdeen, who gave us access to the records of SCE performance.

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(Manuscript received 4th January, 1972)

THE RELATIONSHIPS BETWEEN INTELLIGENCE, PERSONALITY AND CREATIVITY UNDER TWO CONDITIONS OF STRESS

By G. LEITH

(Department of Research in Education, University of Utrecht)

SUMMARY. The experiment set out to determine whether responses to creativity tests are influenced by the personality of the subjects and by the amount of stress imposed by different testing procedures. 106 children aged 9, 11 and 13 years were given an intelligence test and tests of extraversion and anxiety according to test manual directions and three verbal, creativity tests were given in a relaxed atmosphere to half of the children and in a moderately stressful manner to the remainder. The results indicate that the number and originality of responses is greater in the stressful condition and that there is a disordinal interaction of both extraversion and anxiety with stress.

INTRODUCTION

In attempting to define and assess originality or creativity, investigators have claimed that conventional measures of ability fail to detect a wide area of cognitive capacity. This area is thought to be diagnostic of creative ability rather than conventional scholastic aptitude and to represent a sphere which has been overlooked by many educators and psychologists who give weight to intelligence as the major factor in school performance. The claim is that some children may be creative but relatively less able in intelligence tests, while some others have high IQs but score low on tests of creative ability as well as others who score high or low on both (Getzels and Jackson, 1962). The evidence for this position is, however, equivocal (Ripple and May, 1962 ; Butcher, 1968).

Wallach and Kogan (1965) surveyed the research on creativity and concluded that evidence for the existence of a unitary factor of creativity different from intelligence was not well founded. Their own study, however, did provide evidence of coherent clustering among creativity tests and of their independence from IQ. A feature of their design was the adoption of an individual, 'game' approach to measurement. This was intended to overcome the mental-testing atmosphere of previous studies which had group administration, time limits, etc., and presumably invoked the same kinds of personal stress and set-to-respond as conventional tests.

In order to test the hypothesis that removal of a mental-testing atmosphere is an important aspect of measuring creativity, a group of 43 education students was given a number of tests, including the AH5 verbal scale, personality tests and a short set of verbal items similar to items from three of Wallach and Kogan's scales (Leith, 1971). The tests were simultaneously administered to a whole group but many steps were taken to bring about a relaxed atmosphere of responding. Thus, overt precautions to preserve anonymity, the manifest purpose of collecting data for group practical work, avoidance of anxiety-provoking cues and competitiveness, etc., contributed to an informal situation in which external threats were removed.

Findings from this small, pilot study were that : the three kinds of responses which were evoked (Associations, Uses, Similarities) were significantly inter-correlated (as high as 0.6) ; that verbal intelligence had no relationship with

these measures; that extraversion (but not anxiety) was related to creativity scores. These results are consistent with Wallach and Kogan's and seem to endorse the need to avoid conventional group-test methods.

It would be unwise, however, to accept this conclusion without first making some attempt to find contrary evidence. Indeed, another hypothesis might be put forward that, since mild stress may facilitate 'arousal,' and since arousal is claimed to excite wider and more remote sets of associations, then the contrary view is tenable. This counter-hypothesis would assert that, if a test situation is mildly (but not severely) stressful, it will facilitate arousal, a state in which more remote associations than the conventional or stereotyped responses (which occur early in the repertoire) will be facilitated.

It is necessary, therefore, to manipulate experimental conditions to find when subjects respond under conditions of moderate stress and in stress-reduced situations:

- (a) Whether relationships among creativity tests and between them and intelligence are different in the two situations;
- (b) Whether a difference in the number and originality of responses occurs.

The experiment was carried out with 106 boys and girls from three classes (3, 5 and 7) of a school in the area of Konstanz, in Germany. The children were aged 9, 11 and 13, respectively. Half of the children within each age group were randomly allocated to each treatment. One of these was similar to normal test administration, i.e., there were statements about testing the ability to carry out tasks, injunctions to "do your best," instructions to avoid delay, and so on. The other was conducted in a room having pleasant associations, e.g., the cookery room. In this case children were informed that they were helping in experimental work, that their individual scores would not earn or lose credit, that the purpose was to find how many different kinds of words children of their age knew in order to help educators to learn the words which were familiar to them. At the same time they were urged to do their best.

In the same session they completed a short personality questionnaire (Hallworth, 1962) followed by three kinds of open-ended response situations: Think of as many different things as you can like—; as many different ways in which you can use—; as many ways in which X is like Y. Three stimuli of each kind were presented. In the moderate stress (MS) condition a three-minute time limit was announced for each item and show of accurate timing was made. In the reduced stress (RS) conditions, the same three-minute span was unobtrusively applied. A week later, Raven's Standard Progressive Matrices was given, in the children's own classrooms, with standard instructions.

Three kinds of evidence were looked for in the responses:

- (1) Evidence of relationships between six measures of creativity (each set of items being scored for number of responses and novelty) and between creativity and intelligence, and of differences in these correlations, between the treatments.
- (2) Evidence that the MS and RS groups differ in number and novelty of responses.
- (3) Evidence of interaction between personality characteristics (extraversion/introversion and general anxiety) and treatments.

The first question relates to the possibility that certain relationships will emerge more strongly in one rather than the other experimental group. The second refers to the two hypotheses that a relaxed, game-like atmosphere

facilitates flexibility, fluency and novelty of responding or that mild stress induces arousal and hence the same properties of responding. The third anticipates that some kinds of individuals are more easily aroused or, alternatively, are 'freed' by the absence of external constraints, or even that what is facilitating for some may be inhibiting to others.

RESULTS

The six sets of scores were ranked within each treatment group and age level and Kendall's W (which assesses consistency of ranking in three or more ranks) was calculated (Siegel, 1956). The average rank order of the six measures was then correlated with the corresponding ranking of the children's intelligence test scores. Table 1 shows the relationships found.

TABLE 1

INTERCORRELATIONS BETWEEN SIX MEASURES OF CREATIVITY (ASSOCIATIONS, USES AND SIMILARITIES SCORED FOR FREQUENCY AND ORIGINALITY) AND INTELLIGENCE (RAVEN'S MATRICES).

Age Group	13 years		11 years		9 years	
	Moderate Stress	Reduced Stress	Moderate Stress	Reduced Stress	Moderate Stress	Reduced Stress
Experimental Treatment						
Creativity Tests	0.828*	0.471*	0.770*	0.614*	0.635*	0.491*
Intelligence and Creativity	0.303	-0.119	-0.326	0.327	0.172	.329

* $P < 0.01$.

Though the MS groups have slightly higher intercorrelations (W) than have RS groups, it must be emphasised that none of these differences is significant. On the other hand none of the correlations between creativity and intelligence is significant and, it should be noted, both negative and positive relationships are present. Since Raven's Standard Progressive Matrices test, though non-verbal, is highly saturated with 'g' and normally has substantial correlations with verbal tests, the zero level of correlation with the average ranks of creativity tests must be counted as an indication that the two measures are independent. In case the averaging of ranks of the six creativity measures had diminished or scattered links which might otherwise have been revealed, one of the measures was correlated with the average rank of all of them. The index of relationship found was as high as that of the original coefficient.

It can thus be affirmed that the three sets of stimulus materials elicited responses which are significantly intercorrelated in both the frequency and originality methods of scoring. At the same time, the creativity measures are not related to a measure of intelligence. A further point is that though there is a slightly higher relationship among creativity tests in all the MS groups than in the RS groups, the differences are quite small.

While the data presented above are sufficient to make the point that the evidence of clustering and of independence from intelligence obtains in both relaxed and stressed situations, a number of further points can be drawn out. In Table 2 the mean scores of all six measures are presented for each sub-group.

TABLE 2

MEAN CREATIVITY TEST SCORES (SD IN PARENTHESES): CHILDREN RESPONDING UNDER TWO CONDITIONS OF STRESS.

Age Group	13		11		9	
Experimental Treatment	Moderate Stress	Reduced Stress	Moderate Stress	Reduced Stress	Moderate Stress	Reduced Stress
Associations : Frequency	42.9 (12.9)	36.4 (6.1)	33.8 (8.5)	30.9 (5.9)	26.9 (7.6)	18.1 (3.5)
Originality	131.2 (41.0)	114.3 (20.0)	104.0 (31.5)	100.3 (21.9)	69.4 (30.3)	45.2 (13.0)
Uses : Frequency	22.4 (9.8)	22.9 (5.9)	22.1 (7.1)	19.6 (4.3)	13.4 (5.7)	12.8 (3.5)
Originality	72.4 (29.9)	64.3 (23.8)	60.1 (26.3)	55.2 (16.8)	36.2 (25.0)	31.4 (14.1)
Similarities : Frequency	19.8 (11.1)	18.6 (6.1)	15.2 (7.7)	15.4 (3.6)	9.7 (3.9)	9.6 (7.2)
Originality	66.3 (30.9)	53.8 (24.8)	39.3 (24.0)	40.4 (13.4)	28.0 (14.1)	23.0 (19.5)
N	11	12	15	15	25	28

Inspection of the data reveals two salient points. First, the overall averages of the MS groups are higher than those of the RS groups. Second, the variances of MS groups are greater (in many cases, significantly) than the corresponding RS groups' variances. The latter point explains why MS groups have slightly higher correlations than the RS groups. It also indicates the possibility of an interaction effect (which will be taken up later).

In spite of lack of homogeneity of variances, analyses (Walker and Lev, 1953) of all six measures were carried out by a method which adjusts for unequal numbers in cells, the test being robust and tolerant of departures from homogeneity of variance (Baker *et al.*, 1966 ; Box, 1954). The probability levels may be doubled for a more conservative estimate of probability. In the case of the first two measures (Association—frequency and originality) the differences between treatments and between age groups were found to be significant. The remaining four showed significant age-level differences only. Tables 3 and 4 summarise the significant treatments analyses.

TABLE 3

ANALYSIS OF VARIANCE OF ASSOCIATIONS
TEST SCORES (FREQUENCIES).

Source	df	ms	F	P
Treatments	1	55.21	16.38	.001
Ages	2	148.15	43.96	.001
Tr × A ..	2	4.42	1.31	
Error	100	3.37		
Total	105			

TABLE 4

ANALYSIS OF VARIANCE OF ASSOCIATIONS
TEST SCORES (ORIGINALITY).

Source	df	ms	F	P
Treatments	1	334.50	7.51	.01
Ages	2	2239.86	50.32	.001
Tr × A ..	2	53.99	1.21	
Error	100	44.51		
Total	105			

It must be pointed out that, though non-significant, all the remaining treatments differences have the same direction as the above, viz., MS means, overall, are higher than RS means.

In order to gain further support for the interpretation in terms of arousal, it is necessary to show that those individuals who are particularly susceptible to arousal obtain higher scores than those who are less easily aroused. On theoretical grounds (Eysenck, 1970) introverts would be expected to be more readily roused than extraverts. Again, depending on the degree of stress, anxious individuals should more quickly show arousal—though a greater amount of stress may be expected to produce interference. To date, two analyses only have been made of scores on the Associations test, the number of responses measure. One of these analyses classified subjects, within sub-groups, into high and low (above and below the median scores) categories on the results of a test of general anxiety (H.B. Personality Inventory, in German translation). The other analysis made a similar grouping but according to level of extraversion/introversion from the same personality scale (Hallworth, 1962).

Mean scores for the two categorisations are given in Tables 5 and 6. The middle age group had a median extraversion score lower than that of the other two groups and it was dropped from the analysis.

TABLE 5

MEAN NUMBER OF RESPONSES OF
ANXIOUS AND NON-ANXIOUS CHILDREN
ON A TEST OF ASSOCIATIONS.

Age Group	Treatments			
	Moderate Stress		Reduced Stress	
	Anx.	Non-A.	Anx.	Non-A.
13	45.8	40.5	34.5	38.3
11	32.6	35.3	28.3	32.6
9	31.4	23.9	16.9	19.5

TABLE 6

MEAN NUMBER OF RESPONSES OF
EXTRAVERTS AND INTROVERTS (CLASS 5
OMITTED) ON A TEST OF ASSOCIATIONS.

Age Group	Treatments			
	Moderate Stress		Reduced Stress	
	Extr.	Intr.	Extr.	Intr.
13	38.4	46.7	40.2	33.7
9	25.5	30.3	18.0	18.2

Tables 6 and 7 summarise the analyses of variance. In each test (of Association, frequency scores) the treatments difference is very highly significant as is the age levels difference. The effects of greatest interest, however, are the significant interactions of treatment conditions with anxiety and with extraversion/introversion.

TABLE 6

A/V ASSOCIATION (FREQUENCY) SCORES.

Source	df	ms	F	P
Treatments	1	126.75	19.56	.001
Anxiety....	1	.08	—	
Ages	2	282.23	43.55	.001
Tr × Anx.	1	46.76	7.22	.01
Tr × Age	2	8.60	1.32	
Anx. × Age	2	9.19	1.42	
Tr × Anx. × Age	2	0.78		
Error	93	6.48		
Total	104*			

* One Subject 'lost.'

TABLE 7

A/V ASSOCIATION (FREQUENCY) SCORES.

Source	df	ms	F	P
Treatments	1	118.58	18.94	.001
Extraversion	1	5.78	—	
Ages	1	561.12	89.64	.001
Tr × E ...	1	47.04	7.51	.01
Tr × A ..	1	8.82	1.41	
E × A ...	1	1.28	—	
Tr × E × A ..	1	13.01	2.08	
Error	67	6.26		
Total	74*			

* Class 5 omitted.

As was put forward in the 'arousal' hypothesis, anxious subjects in the MS treatment had higher scores than other sub-groups and the corresponding introvert sub-group was also highest in mean score. The interactions are shown graphically in Figures 1 and 2.

FIGURE 1

INTERACTION OF TREATMENTS AND
ANXIETY LEVELS.

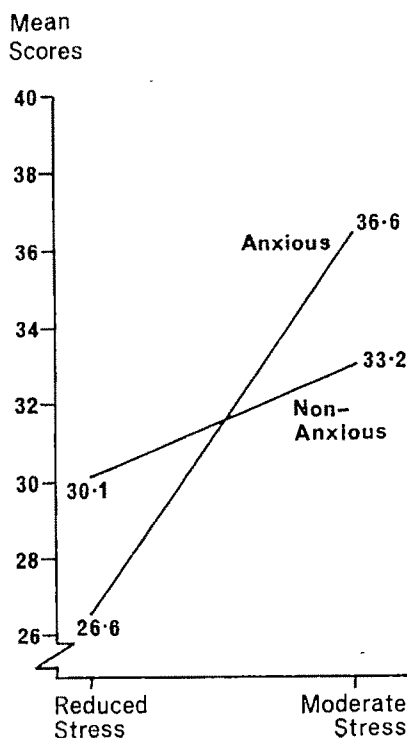
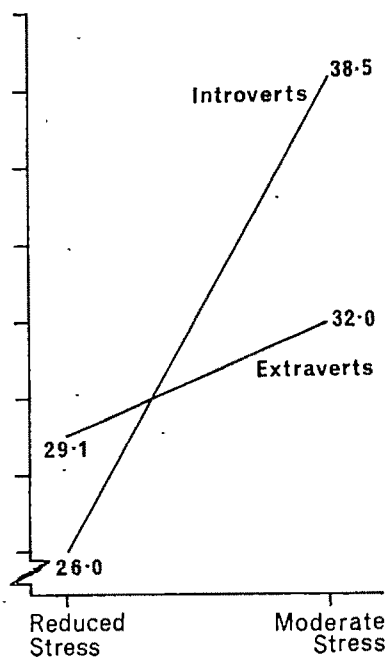


FIGURE 2

INTERACTION OF TREATMENTS AND
AND EXTRAVERSION.



DISCUSSION AND CONCLUSIONS

The experiment was designed to obtain further evidence of the existence of a unitary trait which may be assessed by means of so-called 'creativity' tests and of its independence from general intelligence. At the same time, a particular hypothesis about the optimal conditions for assessing 'creativity' was tested. Wallach and Kogan's view, that their use of individual, untimed, gamelike situations, in which to obtain responses, is important, was first confirmed in a pilot study. In this preliminary investigation a modified procedure was adopted in which group testing was used in stress-reducing circumstances.

The present experiment took up the types of tests and procedures already validated and introduced an experimental contrast between stress-reduced and moderately stress-inducing test-procedures. The contrast was made in order to look for evidence disconfirming of the relaxation hypothesis and specifically to obtain evidence for an alternative view that moderate stress would facilitate arousal—thus inducing a wider range of available associations. On this view mild stress was considered likely to promote better performance on the part of introverts and anxious (i.e., above median) subjects. Also possible is the view that each situation might both help and hinder different kinds of individuals.

All of the hypotheses received confirmation. The creativity measures were significantly intercorrelated and were not significantly related to a measure of general intelligence. Slightly higher inter-relationships were found in the moderate stress condition but the differences were not marked. Stress tended to induce higher scores at all age levels than relaxed conditions, two of the differences being significant.

The hypotheses of interaction between treatments, introversion and anxiety have been verified in the two analyses so far carried out. Introverts and anxious subjects have been held to be more susceptible to arousal than extraverts and non-anxious. The findings, therefore, fit the account of arousal given by Hebb (1955). Since the interactions are disordinal (Lindquist, 1953; Lubin, 1961; though not according to the stricter rule suggested by Bracht, 1970), that is, in MS, while the introverts' mean is higher than the extraverts', in RS their ordinal position is reversed (extravert higher than introvert), the result is consistent with the pilot study's findings of a significant association between extraversion and creativity. In other words there may be some tendency for the responses of introverts to be *inhibited* in the relaxed condition (cf. Eysenck, 1970, pp. 439 ff).

The wider educational implications of these findings must necessarily be tentative and call for further information. If the conclusions set out above receive independent confirmation and elaboration, some hints about current policies and practices could be given. Thus, we could expect guidance about the need for differentiated teaching situations based on individual differences in cognitive style, personality and aptitudes other than general ability. Furthermore, we may be led to question some of the educational trends which foster views about optimal conditions for learning such as children should set their own pace of learning, giving directions is to be avoided, achievement stress must be eliminated, etc.—at least for some children.

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(Manuscript received 23rd January, 1972)

EXPLORATORY STUDIES OF EARLY COGNITIVE DEVELOPMENT

By W. MARY WOODWARD AND M. R. HUNT*

(*Department of Psychology, University College of Swansea*)

SUMMARY. Developments in cognitive processes in the early pre-school years have been studied by observing the actions that young children perform upon objects, while relating them by a spatial relation or attribute. Matching tasks and material for spontaneous handling were given to 31 children aged 19 to 42 months and to 23 severely subnormal children. It is suggested that one aspect of early cognitive development is increasing selectivity in sequences of matching actions.

INTRODUCTION

DESPITE the current interest in the process of cognitive development, there has been a relative neglect of the pre-school period, particularly of the early part of it. Our knowledge concerning young children, too, is often of a negative kind, for example, of an absence of verbal mediation or of classificatory ability. The limited information concerning positive advances becomes evident when a process-oriented approach is adopted in clinical and educational work, especially with severely subnormal children who are in this period of development for much of their childhood. A series of studies has accordingly been undertaken, with the aim of seeking to discover the positive advances made by children of $1\frac{1}{2}$ to $4\frac{1}{2}$ years, compared with the first 18 months of life, and by comparable subnormal children.

Such investigation is necessarily exploratory in the present state of knowledge, and a number of potentially promising lines have been followed in the study being reported. Initial clarification may be sought by reference to the end-points to which early developments are leading. In the view of Piaget and Inhelder, these are transformation systems for handling class-inclusion, seriation and number, and for co-ordinating spatial and temporal relations; these are assumed to develop from sequences of action regulated by observation of outcomes ('intuitive' regulations) in the preceding two or three years. It is thus the latter which may be examined as a guide to what may usefully be observed in pre-school children. Behavioural sequences performed by 5- and 6-year-old children, who are given relatively complex tasks, are interpreted by Inhelder and Piaget (e.g., in 1964) as retroactive, in contrast to the anticipatory analysis attributed to children with operational systems, though the beginnings of the anticipatory avoidance of error may be observed in the transitional period. For example, successful adherence to one criterion in a complex sorting task, with the objects varying in three attributes, is achieved step by step, with errors being committed and subsequently corrected. Selection of an attribute, even if achieved retroactively, is nevertheless, an important feature; the analysis of a sequence of correct moves draws attention to this. Three-quarters of a group of 5-year-old children observed by Woodward (unpublished data) sorted a set of objects that varied in only two attributes, placing them correctly without error. Such correct moves involve a dual selection: for example, if form is the basis of the sorting, and a blue square is picked up, correct placement of it involves selecting the attribute that was the basis of previous placements (not putting it near a blue one of a different shape) and selecting the specific relevant feature within that attribute (placing the object with other square ones).

*Now at Bedford Child Guidance Clinic.

This analysis suggests that the investigation of the preceding period may usefully be concerned with increasing selectivity, in addition to error-correction and anticipation, as suggested by the Piaget and Inhelder analysis. Since pre-school children keep changing the basis of matching with a complex sorting task (Vygotsky, 1962; Inhelder and Piaget, 1964) simpler selection situations are required, that involve the relation of objects by an attribute or spatial relation. Four such situations have been tentatively distinguished. The simplest is when an array of uniform objects is presented, together with something into which they can be put, for example, round pegs and a peg board. Any peg will go anywhere. Thus, it is not necessary to select among the elements, nor to select any particular hole when placing the object; the only selectivity in the action is to put each peg in a hole, rather than somewhere else. Similarly, when a child arranges a scattered collection of objects in 'free space' into a regular spatial pattern, placing each successive one next to the last one, for example, when he makes a line, still no selection among the elements in the array is necessary. There is, however, a greater variety of possible placements than in the first situation. The object may be placed to the left or right, behind, in front of, or on top of the last object placed; the placement thus involves selection among these alternatives. The outcomes are different patterns.

When attributes are the basis of placement, greater selectivity is involved. For example, if objects varying only in colour have been placed in a line, and the child then picks up a blue object (at random) and places it next to a blue one in the line, he is selectively placing an object near a *particular* one, not merely next to any one by proximity alone. Finally, to search a scattered array for an object that has the feature of one that is separate from it involves picking up a particular one, that matches another, rather than picking up any one.

Thus, the present investigation has examined what young normal and older severely subnormal (SSN) children do when presented with varying sets of material and with tasks that require different degrees of selective action. One task was also included for the observation of the early development of error-correction and anticipation.

A different aspect of selection is selecting relevant from irrelevant items. Hence, in some cases, more items were presented than were needed for the task. In addition the area of the child's activities was studied. In a previous investigation (Woodward, 1972) some subnormal children, who were presented with the task of assembling a set of elements that varied in size, overlooked one that had become displaced to the edge of the collection. This finding led to the hypothesis that severely subnormal children (and possibly young normal children) fail in a visual search task because they limit their activities to objects that cover a relatively small area. This hypothesis was tested, in the present study, when the elements were uniform, by presenting the array with one element displaced apart from the rest.

SUBJECTS

A group of 31 normal children consisted of 14 aged 3 to 3½ years, drawn from local authority nursery schools near council housing estates, and 17 aged 19 to 35 months, obtained partly from a nursery school and partly through informal contact. This second source produced some children of graduate parents, and it is thus unlikely that the two age groups are comparable in socio-economic terms. A second group consisted of 23 SSN children aged 4 years 4 months to 13 years 2 months (median=8 years 1 month); these were drawn from two junior training centres, so that they were comparable in experience to the normal children in living with their families.

METHOD AND PROCEDURES

Children were presented with various sets of material, in scattered arrays. The two main variations in the method of presentation were the presence and absence of task requirements. In the interests of clarity the materials are described in the order in which they were given, grouped according to the kind of material, or procedure. These groupings, however, to some extent cut across the various selection situations that were described in the Introduction.

The child was instructed to perform the tasks described in sections A, C and D; those in A could be comprehended by all the children, while the younger could not be instructed in those in sections C and D. The sets of material described under B were given for spontaneous handling. Task E was presented for the observation of error-correction and anticipation.

Each child was seen individually. Several sessions were necessary for all tasks and material to be presented. Strict adherence to a pre-arranged order is not possible with young children; if they do not respond to a task when it is first presented, it has to be introduced again later. In most cases the tasks described in section A were presented in one session, followed by the others in subsequent sessions.

Tasks described in sections A, C, D and E were given to both groups; only two of the sets described in section B (Sets 1 and 3) were given to the SSN group.

A. Fitting Tasks.

Five tasks required spatial placement, of fitting each object into a hole, or onto a stick. In three cases the elements were uniform in size and shape, and any element could be fitted anywhere (tasks 1, 2 and 5). The elements in task 3, to be placed on the same stick, varied in size, but they could be fitted in any order; selection was possible, but not essential. The fifth task was a four-hole form-board. Each block could be fitted in only one place.

The five tasks were as follows:

- (1) A pegboard and 10 round pegs that fitted into 10 round holes, arranged in five pairs.
- (2) A pegboard and 10 round pegs, with 10 holes arranged irregularly with nine grouped together, and one displaced in one (far) corner.
- (3) A set of 12 plastic rings, varying in colour and graded in size, and a stick onto which they could be placed. An additional element included in the array was an irregular piece of black plywood, with a hole in it, large enough for it to be placed on the stick.
- (4) A four-hole formboard (circle, cross, square and triangle). A fifth block (another circle) was included in the array.
- (5) Five 'trees,' each with five sticks, on to which beads (given in six colours) could be fitted.

All sets were presented with the elements in a scattered array near the object into which or onto which they were to be placed. With tasks 1 and 2 one element was displaced apart from the rest, before the child was allowed to see the material.* The child was instructed to place the items in the boards or on the stick.

The tasks, wherever possible, were presented in the order 1 to 5.

* Further details of materials and procedures will be supplied on request.

B. Material for spontaneous handling.

Four sets of material were presented with no specific instructions, other than "Show me what you can do with these." They were sets of separate objects, with no board or stick on which they could be placed or fitted. Any arrangements made of them in 'free space' were of the child's own choosing. Some sets, however, permitted a greater variety of arrangement than others. Two sets (1 and 2) were uniform in shape and size, and varied only in colour. Set 1 consisted of 30 cubes with sides of 25.5 mm (one-inch cubes) in six colours and set 2 of 24 triangular-shaped pieces (wedges) also in six colours. A third set varied in colour, form and size (cubes, flat triangular pieces and long thin rods, each in three sizes and three colours), making 27 items in all. The fourth set was of uniform elements (a box of 100 counters) alike in shape, texture, colour and size; only spatial patterns could be made of these. These sets were presented in the order 1, 2, 3, 4.

C. Induced matching tasks.

The tasks in this section required the child to copy a model, without necessarily having to select a particular item from the array. The model in task 1 was a line of nine items (25.5 mm cubes), each of a different colour, touching, to be matched for colour, with other cubes placed in a line below the model, from an array of 23 cubes in 12 colours. The older children were given a guided trial, in order to instruct them in the task. The child was guided, bead by bead, to place each one he took from the array opposite its matching pair. The child was then instructed to repeat the task on his own; two such non-guided trials were given. If all the nine items were not correctly matched on either trial, a row of five items was presented. The younger children (under 3 years) were first instructed to match one item, which was presented alone, and then rows of two to five items, followed by a non-guided trial with five items, if possible. The nine-item task was given only to those who succeeded with five items.

Attempts were also made to elicit copies of a line and a circle with counters when such patterns had not been made spontaneously.

D. Spatial Order Task.

A task that required selection of elements from an array was similar to the nine-item task described in Section C. It was based on a task of copying a spatial order devised by Piaget and Inhelder (1956). Nine items (25.5 mm cubes) were placed on a vertical rod, the task being to place other cubes onto another vertical rod in the same order, given an array of 23 items, the end points of the rods of model and copy coinciding so that each element, when placed on the copy, was opposite its matching pair. The presence of the rod meant that the beads had to be placed successively on top of one another. Hence, a match with the first item on the model could be achieved only by searching the array for a bead of the same colour, and so on with the others. Errors could be corrected only by removing all the beads placed above a wrongly placed one. Instructions were given in the form of a guided trial to the older children; the task was not given to the younger children who could not be guided through the five-item task described in Section C.

E. Positioning Task.

For the study of error-correction and anticipation, the manner of positioning cubes in a box was observed: left haphazardly placed, readjusted to fit

neatly, or placed neatly in one move by prior orientation. The material used was a box approximately 102 mm. square and 51 mm. deep, and four cubes, with sides of 45 mm., that fitted easily into the box. The empty box and the cubes were placed in a row before the child, who was instructed to "put the bricks in the box." If the child did not respond, the experimenter made a movement towards the box with one of the cubes.

RESULTS

A. Selectivity.

In this section the results are analysed in terms of selectivity, as described in the Introduction.

Four of the fitting tasks (Nos. 1, 2, 3 and 5 described in Section A of Methods and Procedure) required the least selection. Only one normal child showed a behaviour pattern described by Piaget (1955): placing a few items, removing some, placing a few and so on. The rest left the items after placing them, though only 13 of them continued to the end when there were 25 items (task No. 5). In the SSN group three children, who were too restless to be given the tasks, have been omitted from the analysis of results. Of the rest, one performed the 'in-out' and 'on-off' pattern, and the rest fitted the items, though not of all tasks in two cases.

The children of both groups (apart from those with the in-out pattern) attempted to fit the blocks into the formboard, moving incorrectly placed ones elsewhere.

At least one of the sets given for spontaneous handling was used for making some regular arrangement (see the next section for details) by the normal children, with the exception of the child who adopted the 'in-out' pattern with the fitting tasks. He took a few items, one at a time and played at handing one to the experimenter and taking it back again—comparable behaviour with a social twist! Similarly, all of the SSN children except the one with the in-out pattern and another, made a regular arrangement with at least one set.

These arrangements were mainly achieved by the placement of an object next to another, edge to edge, or upon another. Spatial placement in 'free space' in this way was thus as frequent in both groups as fitting things into or onto something else, though younger children used fewer items and sets (see section B for details). When selective placement by a particular object was required, however (as in the matching described in section C), fewer children showed the selective behaviour. Seven normal children (all aged over 3 years) and 10 SSN children succeeded in matching between five and nine items, when not guided by the experimenter (though more succeeded when instructed in respect of each item).

Success with the colour-matching tasks could be achieved either by taking any item in the array and moving it along the model until its opposite number was found, or by selecting from the array the first item on the model, then the next and so on. When records were made of the order in which the items on the model were matched, this was not in a left-to-right or right-to-left order; the first strategy would appear to have been adopted. The spatial order task (described in section D) did require the child to search the array for a particular element, and also to keep track of the next item to come on the model. This task could be comprehended by only 14 of the normal group. None of these succeeded in placing all the nine items opposite their matching pairs, and only three placed as many as three or four correctly. In the SSN group two children

successfully copied the model (all nine items correctly placed). No child in either group corrected any erroneous placements.

The results with these four kinds of material are summarised in Table 1, in the form of patterns of performance of individual children.

TABLE 1

PATTERNS OF PERFORMANCE IN FOUR DIFFERENT SELECTION SITUATIONS.

Type of selectivity				No. of children		
A	B	C	D	Normal	SSN	
—	—	—	—	1	0	A. Fitting, when any element will go anywhere.
(+)	—	—	—	0	2	B. Spatial arrangements in free space.
+	+	—	—	23	8	C. Matching by attribute (copying model, selective placement).
+	+	+	—	7	8	D. Copying spatial order (selecting from array).
+	+	+	+	0	2	+ Behaviour present.
Totals				31	20	(+) Behaviour partially present (for some tasks).
						— Behaviour absent.

It may be noted from Table 1 that the two SSN children who succeeded with the task that required selection from an array (task D), showed selective behaviour with the other three sets of material. Similarly, all the children in both groups who matched items without having to select from an array made spatial placements spontaneously, and completed the fitting tasks. A relatively large number of normal children (23) do, however, fall in the next category (fitting and making spatial placements but not matching). Their behaviour with the sets of material given for spontaneous handling is analysed further in the next section, for the examination of differences within this category.

B. Analysis of spontaneous arrangements.

The results in this section are given for the 30 normal children who made some kind of regular arrangement. These children differ in the number of sets so used and in the extent to which the objects in each set were used; the details are given in Table 2.

TABLE 2

NUMBER OF SETS USED FOR REGULAR ARRANGEMENTS AND USE OF ALL ELEMENTS OF AT LEAST ONE SET.

No. of sets used	All elements used of :		Totals
	1+set	0 sets	
4	10	1	11
3	3	6	9
2	0	8	8
1	0	2	2
Totals	13	17	30

The figures in Table 2 indicate that children who use more sets of material tend also to take all the elements of at least one set. When children using 1-3 sets are combined and compared with those using four sets, the difference in the use of all the elements of at least one set (3 of 19 compared with 10 of 11) is significant at the 0.0004 level (Fisher Exact Test, two-tailed test).

Whereas relatively large numbers of children made patterns with the cubes, wedges and mixed set (28, 24 and 25, respectively), the counters were so used by only 12 children; these 12, with one exception, made patterns with the other three sets. (A few more could be instructed to copy a line and/or circle with the counters, though the younger children could not be induced to do this.) Few children handled the objects without making a regular arrangement (for example running them through their fingers), between one and three of them doing so with the different sets.

Regular arrangements were made by spatial juxtapositions rather than by matching by common properties. No complete sorting on the basis of an attribute was observed, even when the elements varied in only one attribute (cubes and wedges). Any colour or form matches that occurred were occasional juxtapositions of a few elements in the spatial arrangement; even these were infrequent, and they may have resulted from chance rather than selection by a common feature. Only two to three children, with the various sets of material, placed three objects of the same colour together. (Similarly, relatively few children (eight normal and two SSN) put beads of the same colour on one tree). With task 5 described in section A more children, however, (13 of the 14 aged 3 to 3½ years and nine of the 17 aged under 3 years) placed two forms together at least twice, when this was possible, with the mixed set.

The kinds of spatial arrangements that were made have been classified as vertical structures ('towers'), horizontal lines and edge-matched groups (placement of, for example, a cube and triangle, or two triangles, with the edges aligned). Some of the children produced a few small, separate edge-matched groups and others made one large complex structure. The latter defy description, and complex structures have been differentiated from simpler ones on the basis of being made in two or three directions (e.g., double towers, 'walls' or branches added to lines with material uniform in shape, or building upwards and horizontally with the mixed set).

Some of the children who used three or four sets of material made the same kind of arrangement with each. Most of these (N=7) were long-line makers, using all the elements: the line went sideways from the child, and if the edge of the table was reached, the line went round a corner and proceeded in another direction. (These are counted as arrangements in one direction.)

Emphasis, in the analysis of results, has been placed upon concurrences of behaviour in individual children, rather than upon age differences in performance with individual items. When children are grouped on the basis of the number of sets they use, use of all the elements of one set or none, and the variety and complexity of structures made, some consistent patterns of performance emerge. These are shown in Table 3.

The patterns of performance have been further grouped into categories as indicated in Table 3. Children have been placed in categories 0 to 4 by the *absence* of the following behaviours: use of all four sets of material, use of all the elements of at least one set and making a complex structure; children placed in category 5 show two of these behaviours, and those in category 6 show all three. When account is taken of the number of different kinds of arrangement

made (towers, lines, edge-matched patterns), children in categories 0 to 4 may be further differentiated on this basis, though two children in categories 5 to 6 made only one kind of pattern. These were the long-line makers, who used all the elements of two or three sets of material. 15 of the 17 children aged under 3 years fall in categories 0 to 4, and 12 of the 14 aged 3 years and over fall in the other two categories, a difference which is significant, with P of 0.0002 (Fisher Exact Test, one-tailed test).

TABLE 3

PATTERNS OF MANIPULATIVE PERFORMANCE.

Material for spontaneous handling				No. of children	Category
No of sets used	No. of kinds† made	All of 1+ used	Complex structure		
0	0	—	—	1	0
1	1	—	—	2	1
2	1	—	—	1	
2	2	—	—	6	2
3	2	—	—	1	3
2	3	—	—	1	
3	3	—	—	5	4
4	3	—	+	1	4a
3	3	+	+	3	5b
4	1	+	—	2	5c
4	3	+	+	8	6
Total ..				31	

+ = present. — = absent. † — of arrangements in one direction only.

All of the seven normal children shown in Table 1 as succeeding with the matching tasks when not guided, fall in categories 5 and 6 for pattern of manipulative performance. Thus, the insertion of Table 4 into Table 1 would break up the group of 23 children, without producing any reversals of the trend in Table 1.

A final point concerning spontaneous behaviour, when task instructions were not carried out, may be noted. Some children, particularly the younger, handled the material 'in their own way,' which was the way they used the sets given for spontaneous handling: they added items upon or beside the line of the model. Such adding to the model, or copy, or both, was also common among the older children who attempted a copy of the model.

C. Displaced and Dissimilar Items.

The results concerning behaviour in relation to an item displaced apart from the rest, or unlike the others, may be briefly reported. Most children in both normal and SSN groups picked up the displaced item (three normal and two SSN did not with one pegboard task, and one SSN child did not with another). Although 15 normal and four SSN children placed on the stick the dissimilar item that was included among the plastic rings, several of them (seven and one, respectively) queried its presence, sometimes in no uncertain terms—"Dirty!" 12 of the normal children tried to use the extra element for which there was no place in the formboard task. (This was not given to the SSN children.)

D. Spatial Positioning.

Of the 27 normal children who attempted the task of replacing four cubes in a box, two of the 13 aged under 3 years placed the cubes in one move, orienting them before placing them, compared with 11 of the 14 aged 3 years and over, a difference which is significant at the 0.001 level (Fisher Exact Test, two-tailed test). Nine of the 15 SSN children who attempted the task oriented the cubes before placing them. Of the children in both groups who did not so orient the cubes, only two (both young normal children) left the cubes haphazardly placed, without subsequently adjusting them to fit.

When the manner of positioning cubes, in the normal group, is examined in relation to the patterns of selective performance, presented in Table 1, some correspondence emerges. Prior orientation of the cubes is present in children who make selective placements only of types A and B, though those who succeed with an attribute matching task (type C), in addition, also, with one exception orient the cubes before placing them. The figures are given in Table 4.

TABLE 4

MANNER OF POSITIONING CUBES AND PATTERN OF SELECTIVE PERFORMANCE (NORMAL GROUP)

Cubes oriented before placement	Selective action of types A B and C*	No. of children
—	—	13
+	—	7
—	+	1
+	+	6
	Total	27

*—See text and Table 1 for description.

+ = present.

— = absent.

DISCUSSION

The findings of this investigation suggest that a fruitful approach to the study of early cognitive development is to analyse variations in the selectivity involved in different kinds of actions by which children relate two objects. The results presented in Table 1 suggest that children move from relating objects spatially, in a simple way, to matching them by an attribute. The two kinds of spatial placement that were distinguished in the Introduction (fitting, when any element will go anywhere and placing an object next to or upon another, in free space) appear to occur together, after children move beyond the 'in-out' or 'on-off' pattern described by Piaget (1955) as typical of the first half of the second year. Further developments were, however, found in the second kind of activity; these included not only changes in the number and complexity of arrangements made, which might have been expected, but also the not anticipated one of an increase in the number of elements and sets of material used. The latter may reflect a factor of sustained attention, which Kagan and Kogan (1970) regard as important in early cognitive development.

A further point about these early juxtapositions of objects is that a feature of the objects may determine whether or not younger children make arrangements in free space: this is the presence or absence of straight edges in the material. Aligning discs in free space involves no more selective placing than does aligning cubes or triangular wedges. Yet few children did this with the counters, while most did something with the other sets. The behaviour that Inhelder and Piaget (1964) term 'edge-matching' was shown with dissimilar forms; this may also be the basis of the alignments with similar forms, such as cubes. Successive edge-matching of cubes will result in a line.

With regard to the relation of two objects on the basis of an attribute, the present results suggest that selective placement of any one taken from an array is an earlier development than search of an array for an object with a particular property. The difference may lie in the involvement of a memory factor in the latter activity: it is necessary to hold, during the search, the property of the object for which a match is sought. When an object is moved among others until its matching pair is found, only successive perceptual comparisons are necessary. The task involving a search that was used in this study, with which no normal child succeeded (though success increases in frequency after the age of $3\frac{1}{2}$ years, Hunt (unpublished data)) also required the child to keep track of where he had arrived, when he was copying the order of the elements on the model; study of search behaviour, with the second feature absent, may find an intermediate step. The field that is searched would not appear, however, from these results, to be limited to the area of objects close together.

The suggestion that children pass from making spatial placements, by matching edges, to matching by a common property (examined only with reference to the attribute of colour in this study), has to be examined in relation to the finding that some children, including younger ones, made more use of form than of colour in their spontaneous arrangements; this, on the face of it, appears to be matching by an attribute. Shifts in colour-form dominance may thus be an alternative explanation. The early study of Brian and Goodenough (1929), of choice of form or colour in matching, found a shift from form to colour at about the age of $2\frac{1}{2}$ years, and a subsequent shift to form again at about $4\frac{1}{2}$ years. Later investigations have concentrated on the latter shift (e.g., Suchman and Trabasso, 1966; Corah, 1966). Corah (1966) has suggested that in addition to a possible preference for colour, choice of colour may also occur from lack of attention to contour, in children who have had little experience of the forms. The earlier preference for, and use of, form, may also be a matter of easier attention to form over colour—though to gross features of form rather than to contour. The three-dimensional objects used in the present study (cubes, flat triangular pieces and long, thin rods) were clearly different in the ratio of the three diameters, as well as in contour form, being chunky, flat and rod-like shapes. To place together three-dimensional objects, which are differentiated from others by several cues, is a different matter from matching two patterns that are alike except for abstract contour form, or colour, and even more so from matching two that are alike in one property and different in another.

A similar point about ease of matching when there are several cues to similarity simultaneously present may be made concerning the results of a study of Ricciuti, quoted by Flavell (1970). Children of 1 and 2 years are reported to have separated beads from clay balls. The objects of one set differed from the others in several dimensions, as did the item rejected or queried by children in the present study (the dissimilar item in the rings and stick task).

When extra items were similar to relevant ones, and were irrelevant only after the number required for the task had been chosen, they *were* in fact used by most children in the present study. Children continued to add beads or counters to the model or copy or both, often until all were used up, and on to the rods with the spatial order task until there was no room for more. The task, as conceived by the experimenter, is, however, not necessarily that adopted by the child. Children who built upwards or beside the model were doing what they did with the material given for spontaneous handling. They would thus appear to be applying existing behaviour patterns to the copying tasks, or, to use Piaget's concepts, assimilating the instructions to their own schemata. Rather than discarding children who do not comprehend the instructions, we might do well to examine the relation of what is comprehended to existing developments.

The question of the task adopted by the child is also raised when the spontaneous correction of errors is considered, in matching and fitting tasks; this question is not raised when errors are eliminated over a series of trials in problem-situations of a barrier type, when 'trial-and-error' attempts are made. Without social reinforcement or other forms of adult intervention, errors in fitting, matching and copying tasks can be recognised as such only in relation to the end-result towards which the actions appear to be directed. When the child moves an incorrectly placed block until he finds the hole into which it fits it would appear that he is aiming to fit the block into something; similarly if he corrects an error in colour-matching he would appear to have adopted the task of matching colours.

The absence of error-correction with the matching and spatial order tasks among children in the present study, and the correction of errors with small formboards by children as young as 18 months may be due to different conditions for the recognition of errors. Attempts to fit things into places where they cannot be fitted gives unavoidable feedback of error. No such unavoidable feedback is given when an error is made in copying tasks when colours and outline forms are matched. This requires an act of comparison. A further point concerning frequent experience in everyday life of things not fitting is that this may lead the child to learn to make anticipatory orientations before placing an object, as the older children in this study did when they placed cubes in a box, from which other anticipatory actions may develop.

To speak of anticipation in this sense, and of the adoption of a matching-by-attribute task, does not necessarily imply that the child of 2 or 3 years envisages at the start the final end-result of the arrangement he is making with a set of objects. It is more economical to infer that the child is performing an action that relates two objects in the same way that he related two in the previous action. In spontaneous arranging the first one presumably is a matter of chance. When children build towers and make lines, the envisaged end-result, if present at all, may involve no more than the outcome of placing or fitting two objects. Whether this is so also when older children successively match objects by a common property, spontaneously, or upon instruction to sort or copy a model, is a matter of conjecture. The study of Bem (1970) at least indicates that to show young children the end-result to be obtained facilitates the comprehension of verbal instructions. These considerations indicate that, in further study of the pre-school period, it may be useful to examine the inter-relations of task comprehension and adoption, anticipation of the end-result and error-correction, when the behavioural sequences concerned involve varying degrees of selection.

ACKNOWLEDGMENTS—We are grateful to the Director of Education, Swansea Corporation, for granting research facilities in nursery schools and to the Medical Officers of Health, Swansea Corporation and Glamorgan County Council, for granting permission to observe children in junior training centres. We would also like to thank the Social Science Research Council for their provision of a grant to support the research.

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(Manuscript received 27th January, 1972)

A DEVELOPMENTAL STUDY OF ATTENTION

By A. GALE

(*Department of Psychology, University College, Swansea*)

AND R. LYNN

(*Department of Psychology, New University of Ulster*)

SUMMARY. This is a study of the development of attention in young children. A continuous response, 40-minute auditory vigilance task, was administered to 612 children between the ages of 7 to 13. Performance improved with age, with greatest improvement between the ages of 8 and 9. Girls were significantly better than boys at ages 7, 8 and 12. There were no correlations (within sub-samples) between vigilance performance and intelligence (Raven's Progressive Matrices and Crichton Vocabulary Scale) or between vigilance performance and personality (extraversion and neuroticism scores on the Junior Eysenck Personality Inventory). All age groups showed variation in performance (the 'vigilance decrement') within the task. Results are compared with previous findings and it is concluded that (i) attentional capacity is independent of intelligence and (ii) that critical changes in this capacity may occur between ages 8 and 9.

INTRODUCTION

ATTENTIONAL factors have been identified as a possible source of error variance in studies of cognitive development. However, there appear to have been no studies of the development of attention as such. The only real difficulty is a technical one, of finding a suitable task. Studies of physiological indicants of attention (i.e., the orienting response, Lynn, 1966) have been limited to neonates or to comparisons between criterion groups of brain-damaged and normal children (e.g., Hutt, Lenard and Precht, 1969). The cost and labour required for such electro-physiological investigations has precluded extensive developmental study.

The most commonly employed performance task devised for the study of attention in adults is the vigilance task, first used by Mackworth (1944) to simulate radar-watching conditions. Research in this area has been extensive, and excellent reviews of the key findings are given by Mackworth (1969, 1970) and Davies and Tune (1970). Vigilance tasks typically require detection of infrequent, irregular and barely discriminable signals ('wanted signals') against a background of monotonous and repetitive stimulation; in order to perform well, subjects must sustain attention for long experimental periods. Davies and Griew (1965) review studies of ageing and vigilance and conclude that age is not a significant factor in performance. But their review examines evidence relating to young adults and the aged; there is no empirical evidence to support their conclusion in relation to the *lower* age ranges. One source of this neglect is the difficulty of testing young children under vigilance conditions, since testing requires prolonged and monotonous isolation. We have overcome this difficulty by devising a group vigilance task, suitable for administration to children in their normal class groups. The task, therefore, generates developmental data relating to attention on a larger scale than would be possible with individual vigilance testing or with physiological instrumentation.

The task involves continuous response, with differential response for 'wanted' signals. Continuous responding is necessary to reduce transmission

of cues between subjects in the group. Intelligence tests were administered to a sub-sample to examine the possibility that individual differences in vigilance performance are related to measured intelligence. Previous studies (Ware, 1961) have failed to show such a relationship and indicate that vigilance capacity is independent of intelligence. However, there is considerable evidence that personality (extraversion-introversion) influences the capacity for sustained attention in adults (Eysenck, 1967). The Junior Eysenck Personality Inventory was, therefore, administered to a sub-sample of 7-year-olds to test for the existence of such a relationship in young children.

PLAN OF THE INVESTIGATION

(i) *Subjects.*

Nine schools in the Exeter area (five junior and four secondary) were invited to co-operate in this experiment. Only three schools agreed to do so: one junior, one secondary for girls, and one secondary for boys. For the 7- to 10-year-old age groups, the sample has, therefore, been drawn from one school only. The entire attending population were tested ($N=351$). This school is located on a council housing estate on the outskirts of Exeter. It is co-educational and partially streamed. The children are largely from Social Classes III, IV and V, with only a small sprinkling of children from Social Class II. The distribution of intelligence for this school was, therefore, somewhat attenuated at the upper tail, compared with manual norms for the population as a whole. There were, at the time of testing, no co-educational or comprehensive secondary schools in Exeter. In order to obtain a reasonable match for social class and intelligence between the 7- to 10-year group and the 11- to 13-year group, it would have been necessary to test in at least four secondary schools (one secondary modern and one grammar school for each of the sexes). Since co-operation from such schools was not forthcoming, it was decided to test the A and B streams only of the one boys' and one girls' secondary modern schools which agreed to participate. The intention was to obtain a sample symmetrically distributed about the mean for intelligence. Since the high intelligence group for the older children were inaccessible (being at grammar schools), no attempt was made to test the available very low intelligence groups (C streams in the secondary modern schools). Mean and range of intelligence scores for the 11- to 13-year sample were 101 and 88-118 (Moray House Verbal Reasoning Test); individual scores were not made available. The 11- to 13-year sample cannot, therefore, be regarded as a continuous extension of the 7- to 10-year sample. The social class background was similar, however. In all, there were 612 children in the sample, of age range 7 years 4 months to 13 years 6 months. All testing took place within a period of two weeks during the month of November.

(ii) *Experimental Procedure.*

(a) *The Vigilance Task.* The children were tested in their normal class groups (mean size 31 children). To avoid the possibility of time of day effects, testing was carried out after 12 noon at one of two times: 1.45 to 2.45, or 3.00 to 4.00 p.m. Subjects were instructed to listen to a tape recording lasting 40 minutes. The tape consisted of a continuous series of random letters presented at the absolute rate of two every three seconds. The subjects responded to each letter by ticking one square on a sheet of squared paper. 'Wanted' signals (single digits occurring in the place of a letter) were presented at a rate of one per minute but randomly placed within each minute. Thus, the

subjects heard the following: "a n l x b s r s m k 3 p t o . . ." The subject responded to the 'wanted' signal by writing the digit itself in a square, rather than placing a tick in the square. Thus, the subjects were kept continuously active throughout the task. This procedure overcomes the major problem of administering group vigilance tasks. Normally, the subjects are instructed to respond only to the 'wanted' signals; thus, in a group situation, it is difficult to prevent those subjects who *have* observed the 'wanted' signal and who respond to it, from transmitting cues to other subjects. (Subjects might be responding to other subjects' responses rather than to the 'wanted' signal itself). Our procedure, which keeps all the subjects continually active, reduces the possibility that such cues will be perceived. There is no real substitute, of course, for individual testing and it is unlikely that *all* such cues may be eliminated in the group situation. It is also likely that there are individual differences in the capacity to benefit from such cueing and that extraverted subjects are at a particular advantage (Davies and Tune, 1970). Prior to the actual administration of the task, subjects were given a thorough training session. No subject failed to understand the instructions. The procedure (training and task proper) lasted one hour.

(b) *Intelligence Tests.* Raven's Coloured Progressive Matrices and a modified version of the Crichton Vocabulary Scale were administered during the following week to the 7- to 10-year sample only ($N=351$). The vocabulary scale employed the synonym version only of Sets I and II, which enabled a doubling of the synonym items and a broadening of the range of scores. Individual intelligence scores for the 11-13-year group were not available.

(c) *Personality Test.* The Junior Eysenck Personality Inventory (JEPI) was administered to the 7-year-old children only ($N=67$), since only this age group was made available.

RESULTS

(i) *Vigilance Performance: Omission Errors.*

Each individual response sheet was scored for errors of omission, giving a score for each subject for each of the 'wanted' signals. Errors of commission were also scored. However, these were so rare that further analysis was inappropriate. Mean and range scores for omission errors for each age/sex group are given separately in Table 1. One-way analyses of variance were performed on the age group scores for boys and girls taken both separately and together. In all cases there was a significant improvement with age: (boys: $F=29.098$, $P<0.001$; girls: $F=5.044$, $P<0.005$; boys and girls combined: $F=32.260$, $P<0.001$). The analyses of variance were followed by *t* tests (within and across sexes) in order to locate more precisely the source of the age differences (Edwards, 1962). The following comparisons were significant:

(i) *Boys (Age Comparisons).* 7-year-olds are inferior to ($<$) 9, 10, 11, 12 and 13-year-olds ($P<0.001$); 8-year-olds $<$ 9, 10, 11, 12 and 13-year-olds ($P<0.001$); 9-year-olds $<$ 11 ($P<0.02$), 12 and 13-year-olds ($P<0.001$); 10-year-olds $<$ 12 ($P<0.01$) and 13-year-olds ($P<0.05$).

(ii) *Girls (Age Comparisons).* 7-year-olds $<$ 10 ($P<0.05$), 11 and 12-year-olds ($P<0.001$); 8-year-olds $<$ 10 ($P<0.02$), 11, 12 ($P<0.001$) and 13-year-olds ($P<0.01$); 9-year-olds $<$ 11 ($P<0.01$), 12 ($P<0.001$) and 13-year-olds ($P<0.02$).

TABLE 1

VIGILANCE SCORES: MEAN ERRORS OF OMISSION.

Age	Boys			Girls			Sexes Combined		
	N	Errors	Range	N	Errors	Range	Errors	Decrement	
								0-8 min	9-16min
7	31	9.48	1-29	36	5.30	0-23	7.24	0.73	1.22
8	48	8.63	1-27	41	4.56	0-17	6.75	0.44	1.59
9	54	3.65	0-15	40	3.27	0-11	3.49	0.16	0.60
10	57	2.93	1-12	44	2.75	0-12	2.85	0.32	0.67
11	32	1.40	0-9	54	1.75	0-7	1.63	0.13	0.57
12	66	1.60	0-9	56	1.09	0-6	1.37	0.06	0.35
13	35	1.57	0-9	18	1.50	0-8	1.55	0.14	0.35

(iii) *Boys and Girls (Compared at Different Ages)*. 7-year-old boys < 7-year-old girls ($P < 0.01$); 8-year-old boys < 8-year-old girls ($P < 0.01$) and 12-year-old boys < 12-year-old girls ($P < 0.001$).

(iv) *Boys and Girls Combined (Age Comparisons)*. A Scheffe multiple comparison test (Edwards, 1962) demonstrated that the difference between 7- and 8-year-olds (taken together) and the remaining age groups (i.e., 9-13 years, taken together) accounted for the variance revealed in the main analysis of variance ($P < 0.01$).

(ii) *Vigilance Performance: Decrement.*

Omission scores were subdivided into 5×8 -minute periods. Mean errors scores for first and second, 8-minute periods are given in Table 1. All groups showed a considerable decline in performance during the second 8-minute period and maintained that level for the remainder of the task. Thus, mean errors for all 612 subjects, for the 5×8 -minute periods were: 0.27, 0.73, 0.74, 0.63 and 0.68. Since individual errors scores per period were low and yielded many ties, no statistical analysis was strictly appropriate. (If ties are neglected (Siegel, 1956) sign tests show first and second periods for all groups to be significantly different: $P < 0.02$).

(iii) *Vigilance and Intelligence.*

The correlations between the tests and vigilance performance were negative and insignificant, both for individual age groups and overall with age partialled out. For example, in the latter case, the product-moment correlation (r) for vigilance and matrices was -0.145 and that between vigilance and vocabulary -0.016 . These correlations were derived for the 7- to 10-year groups only.

(iv) *Vigilance and Personality.*

The correlations derived for the 7-year group between vigilance and both extraversion and neuroticism were negative and insignificant, i.e., r for vigilance and extraversion was -0.09 and for vigilance and neuroticism, -0.06 ,

DISCUSSION AND CONCLUSIONS

The results may be summarised as follows: (i) Capacity for sustained attention as measured by this task improves with age, with an acceleration in performance between ages 8 and 9 years. (ii) Girls give consistently higher performance than boys, but this sex difference diminishes with age and ceases to be significant from ages 8 to 11 years. The sex difference does become significant again at 12 years. (iii) All groups exhibit a decrement in performance following the first 8-minute period. (iv) There is no correlation with intelligence for this task (7-10-year groups only). (v) There is no correlation with either extraversion or neuroticism (7-year group only). (vi) However, examination of scores for individual children reveals a number of extreme cases; namely, children of 7 years who give 100 per cent performance, and at the other extreme, children of 9 and 10 years who perform at a level well below the mean score for 7-year-olds. (Where the relevant data were available extreme cases were distinguishable neither on the basis of intelligence nor personality scores.)

How do these results fit in with previous studies of vigilance and with theoretical interpretations of vigilance? The improvement with age, though hardly surprising, appears at an interesting point. Fois and Low (1961) report a shift to higher frequency and lower voltage EEG between 8 and 10 years, until by 11 years the resting EEG begins to show the characteristic features of the adult, more 'aroused' EEG. Bickersteth (1917), in a developmental study of capacity for self-paced continuous tapping, also obtains a maximum increase in performance between the ages of 8 and 9. Thus, the Bickersteth study, the present study, and the EEG data, point to some change in attentional capacity at this age. Further studies are required, however, before any definite conclusion may be reached.

At the same time, it must be acknowledged that 'attention' is a polymorphous concept, and the present task may not be considered as ecologically appropriate to the classroom. Studies with adults do demonstrate, however, that, apart from exhibiting variation in performance and systematic variation in physiological reactivity, the subject also experiences subjective changes in alertness during tasks of this nature (Gale, Haslum and Penfold, 1971). The task, therefore, reflects aspects of attention which are immediately recognisable as such. Until the role of attention in learning has been described in more detail, the vigilance task will remain the best measure of sustained attention available to us. The particular version employed here was deliberately oversimplified to enable age comparison. Increase in the order of difficulty or in cognitive complexity is not precluded.

The differences in performance for boys and girls may be a reflection of general sex differences in developmental rate (Tanner, 1961). For example, Kagan (1964) suggests that greater reading difficulties commonly reported to be more prevalent among boys are associated with sex-role differences in the perception of the school. It is possible, however, in the light of our findings that such reading difficulty is attributable in part to a more fundamental attentional deficiency (of a biological rather than socio-psychological nature), independent of measured intelligence, but related developmentally to sex. Thus, there might be an inherent tendency among boys rather than girls for attentional capacity to lag behind the development of measured intellectual capacity.

The decrement in performance is a typical feature of vigilance tasks and demonstrates that in spite of group administration performance follows the normal pattern.

The failure to correlate performance with intelligence confirms earlier findings (Ware, 1961) and again indicates the possible existence of attention as an independent factor.

Previous studies support the view that introverts are superior to extraverts on tasks involving continuous attention. There is no reason either on theoretical grounds or on the basis of previous studies to expect a relationship between neuroticism and vigilance. Two testing conditions which improve the performance of extraverts are group testing and afternoon testing (Colquhoun, 1960; Colquhoun and Corcoran, 1964). Thus, our failure to obtain a relationship between extraversion and performance might well be attributable to our testing conditions. Individual rather than group testing might yield different results. However, there are grounds for suspecting the reliability (and, therefore, possibly the validity) of the JEPI itself (e.g., Bennett, 1972).

A more intensive study of individuals with performance levels deviating excessively from the mean levels for their age is at present under way. It is possible that other indices of attentional capacity also reflect those differences in vigilance performance indicated by the present study. Thus, in a further study (Gale and Lynn, in preparation) comparing good, medium and poor vigilance performers among the 7-year-olds in the present sample, we have shown that these criterion groups are distinguishable on two further tasks. Good vigilance performers are *more* physiologically reactive than poor performers (habituation of the orienting response, Lynn, 1966) and obtain *lower* scores in a free operant button-pressing 'stimulus-hunger' task (e.g., Gale, 1969). Such findings provide strong support for an arousal theory interpretation of individual differences in vigilance performance and also provide external validation of the present findings.

ACKNOWLEDGMENT—This work was supported by a grant to the second author from the Medical Research Council (Reference G936/234/B).

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(Manuscript received 20th March, 1972)

THE SAGA OF BUTCH AND SLIM

By J. WARD

(*Faculty of Education, University of Victoria, British Columbia*)

SUMMARY. The construction of the new British Intelligence Scale (BIS) has now reached the stage at which items are being selected for inclusion in a standardisation test. The data upon which these decisions are mainly based were obtained from a large scale try-out experiment carried out on a national scale and within which the effects of intelligence level, socio-economic class, sex and geographical locations were examined. The article describes the later stages in the development of a series of reasoning items for the Operational Thinking sub-scale. "Butch and Slim," a logical 'game,' was based upon the combinatorial of 16 binary propositions of p and q and represents an attempt to integrate developmental material into a factorial framework. The items were subjected to try-out in the main BIS experiment and other data were obtained from additional sources. The results broadly justify the rationale adopted for the items, an outstanding feature being clear developmental trends in the ability to carry out operations involving negation. Some promising evidence as to reliability and validity emerged and, in general, psychologists involved in the try-out were positive about the items. Further analyses of error patterns did not reveal clear qualitative differences between age groups. The strategies employed by subjects in responding to problems of equivalence, incompatibility, implication, negation and disjunction are described. A number of substantial modifications to the items are suggested.

INTRODUCTION

MANY writers have commented upon the common ground between the approaches of developmental psychologists such as Piaget and his co-workers and the work of psychometrists working in the area of cognitive growth. Elkind (1969), for example, points out the strong emphasis that both place upon the process of logical reasoning, although it must be stressed that this has had little effect on test construction. For instance, such widely used tests as the Stanford-Binet Form L-M (Terman and Merrill, 1960) and the Wechsler Intelligence Scale for Children (Wechsler, 1949) contain very little in the way of formal inference items. And despite the early work of Burt (1919), most recent work (Valentine, 1961; Heim, 1964) has been concerned primarily with the study of high levels of intelligence.

Piaget and Inhelder (1969) consider that the clinical method is unsuitable for orthodox psychometry and not unnaturally most workers who have attempted to adapt items (Tuddenham, 1969; Ayers, 1971; Lunzer, 1970) have noted considerable difficulties. However, provided that a liberal psychometric attitude can be adopted, some of Piaget's experimental situations form a potential source of items which possess the advantage of having a definite rationale. For this reason, the plan for the new British Intelligence Scale (Warburton, 1970; Warburton *et al.*, 1970) provided for the incorporation of materials and procedures from developmental psychology into a multi-factorial framework. Some of this early work on the scale has been described by Ward and Fitzpatrick (1970) in their account of their try-out of a logical game, "The TV Game." This was based upon the combinatorial of the 16 binary propositions of p and q (Piaget, 1949) and although many difficulties were encountered it

was felt that the 'game' was extremely promising. The following, therefore, will report a further stage in the development of this form of item: "Butch and Slim." It is anticipated that it will be of particular interest to those concerned with cognitive growth in adolescence and to the many psychologists seeking information on the progress of the British Intelligence Scale (BIS).

BUTCH AND SLIM

Butch and Slim was written as a response to a need for a rather specialised group of items in the Reasoning sub-scale of the BIS. It was proposed that these items should have, if possible, the following characteristics: They should be . . .

- (1) suitable for children of both sexes from the age of about 10 years,
- (2) deductive rather than inductive in nature, thereby introducing a useful dichotomy into the Reasoning sub-scale,
- (3) predominantly verbal in character,
- (4) maximally interesting, if possible facilitating verbal interaction between examiner and subject,
- (5) reflective of qualitative differences between pre-adolescent and adolescent thinking,
- (6) capable of discriminating children of high intelligence,
- (7) adequate with respect to the usual psychometric criteria for selection.

It was realised that most of these requirements could be met by a range of verbal reasoning items of the linear syllogism type. In addition to their established psychometric utility, these are attractive to the subject and can yield analyses of error patterns (Hunter, 1957; Donaldson, 1963). Accordingly, a range of such items was provided. However, it was felt that, since the sub-test for which the items were proposed (the Operational Thinking Scale) was mainly Piagetian and experimental in character, a more adventurous approach should be tried out. Clearly the experimental situations used by Inhelder and Piaget (1958) were too cumbersome and time-consuming for inclusion in an individual test. The test writers were grateful, therefore, for an idea which originated in the committee of the British Psychological Society which set up the research. This was for a game of propositional logic which, it was anticipated, would meet the requirements in full detail. The construction of these items had been a long and difficult process. The first stage of the work is reported by Ward and Fitzpatrick (op cit.); the second stage by Ward (1971). The following represents what is perhaps a penultimate phase in the production of this type of item for the BIS procedure.

METHOD

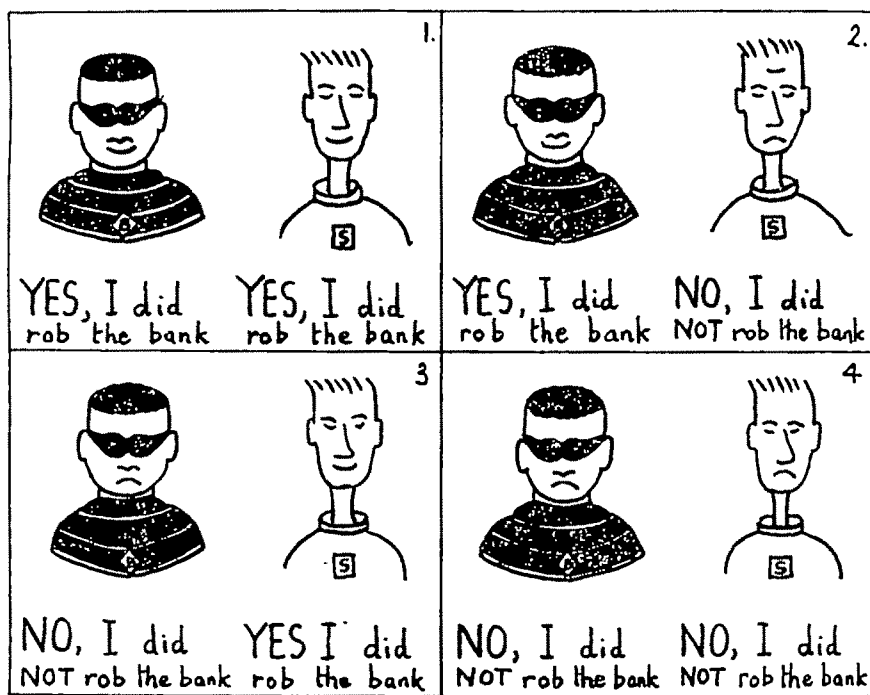
"Butch and Slim" Game of propositional logic. (Operational Thinking Scale—reasonably able subjects aged 10 years onwards).

Materials: Four cards 3 in. × 2 in. (76.2 × 50.8 mm.) on each of which appear pictures of two imaginary criminals, "Butch" and "Slim." Under each criminal is written "Yes, I did rob the bank" or "No, I did not rob the

bank," as his response to the question : " Did you commit the robbery ? " The cards are shown in Figure 1.

FIGURE 1

MATERIAL FOR " BUTCH AND SLIM " GAME.



Spread out four cards before the subject and say, " This is a game about a bank robbery. There has been a bank robbery and two well-known criminals, ' Butch ' and ' Slim ' are suspected. Here is Butch—(point), and here is Slim—(point). Now, supposing these two were taken in and questioned together, in the same room, as to whether they committed the crime, they could only really answer four different ways : both of them could say, ' yes,' they did it, like this—(point to Card 1) or Butch might say that he did it and Slim deny it, like this—(point to Card 2). Or Butch might deny he did it but Slim admit it like this—(point to Card 3). Then, of course, both might say ' No ' like this—(point to Card 4). So when they were asked if they committed the crime, they could answer in the four ways shown on these cards. Now I am going to tell you some statements Butch might have made to the police, and each time I want you to look at each of these cards in turn and tell me whether Butch and Slim's answers on the cards could be true or not. You are looking for cards which could agree with what Butch said "

Experimenter should emphasise that Butch is speaking.

ANSWERS:

Cards:

True False

- 1 2, 3, 4 (1) "Slim and I robbed the bank together."
If the subject responds wrongly or does not understand, point to Card 1 and say, "This is the only one which can be true because this is the only one which both admit to the robbery."
"Now try this one. Butch said"—
- 2, 1, 3, 4 (2) "I robbed the bank on my own."
In case of error or misunderstanding, point to Card 2.
"This is the only one which can be true because this is the only card where Butch is saying, 'Yes' on his own."
"Try this one. Butch said"—
- 2, 4 1, 3 (3) "I am certain Slim did not rob the bank."
In case of error, point to Cards 2 and 4 and say, "These could both be true because Slim says 'No,'"
Administer rest of Item. The experimenter may repeat statement if requested. The experimenter should precede each statement with the words "Butch said"—
N.B.—Where the subject appears to be guessing, it is desirable to ask him why he made his choices. If he cannot explain, mark as a fail.
- 1, 2 3, 4 (4) "I robbed the bank, but I am not saying whether Slim robbed the bank with me."
- 1, 2, 3 4 (5) "At least one of us robbed the bank."
- 3, 4 1, 2 (6) "I certainly did not rob the bank."
- 1, 3 2, 4 (7) "I am sure that Slim robbed the bank."
- 2, 3, 4 1 (8) "We could not have robbed the bank together."
- 4 1, 2, 3 (9) "Neither of us robbed the bank."
- 2, 3 1, 4 (10) "Only one of us robbed the bank."
- 3 1, 2, 4 (11) "Slim robbed the bank on his own."
- 1, 4 2, 3 (12) "If we did rob the bank, we did it together."
Should the subject give 1 and not 4, say:
"Well 4 could be true, couldn't it? After all, Butch said 'If we did it': They may not have done it."
- 1, 2, 3 4 (13) "If Slim did not rob the bank, I robbed it."
- 1, 3, 4 2 (14) "If I robbed the bank, Slim robbed the bank."
- 1, 2, 4 3 (15) "If I did not rob the bank, Slim did not rob it."
- 2, 3, 4 1 (16) "If I did rob the bank, Slim did not rob it."

NEGATION "Now let us play the game a different way. Let us suppose that whatever Butch says is a lie. Which of the cards could be true when Butch is telling a lie?"

N.B.—For Negation, the 'False' answers now become 'Correct.'

Statement (1) If the subject does not appear to understand, point to Card 1, and say, "It cannot be true because what Butch says is a lie, but all these could be true"—(point to Cards 2, 3 and 4).

Statement (2) If the subject fails or does not understand, point to Card 2, and say, "This was true but cannot be true now because Butch is telling a lie."

The experimenter points to Cards 1, 3 and 4: "These could now be true then, couldn't they?" Give no further help with rest of statements. N.B.—Before each statement say, "Remember, Butch is telling a lie."

The provision of a third example in the introductory procedure was absolutely necessary since, without it, subjects tended to view the task as a sort of multiple choice situation in which only one of the four cards was correct. Despite example 3 this initial 'set' persisted in many cases: for instance, on item 4 Card 2 would be chosen and the subject would sit back considering the task accomplished. The convention was therefore adopted of asking the subject "Could any more of the cards be true?" irrespective of whether the full range of correct cards was chosen or not.

Recording.

The examiner underlines or circles each choice of a card on the response sheet in order to facilitate an analysis of error patterns at a later stage.

The Rationale.

Butch and Slim is based directly upon Piaget's combinatorial analysis of children's thinking in adolescence which was postulated in *Traité de Logique* (1949) and later subjected to major programmes of experimental verification (Inhelder and Piaget, 1958). The combinatorial involves a simple calculus of bivalent propositional logic which is usually referred to as "The 16 binary propositions of p and q " and which is described in great detail in the first work cited. Piaget uses examples taken from zoological classification for the logical elements of the combinatorial but these are explained in simpler form in other accounts (e.g., Piaget and Inhelder, 1966). Other adequate explanations are given by Flavell (1963), Peel (1960), Boyle (1969) and Hunt (1961). However, taking any two propositions p and q in combination, these can be symbolised in four basic ways:

$$(p \cdot q) \vee (\bar{p} \cdot q) \vee (p \cdot \bar{q}) \vee (\bar{p} \cdot \bar{q})$$

These can now be entered in a truth table in the following 16 different ways:

- | | |
|--|-----------|
| (1) any one of the four compound propositions can be true .. | 4 entries |
| (2) any two of the four can be true | 6 entries |
| (3) any three taken together of the four may be true | 4 entries |
| (4) all four can be true at the same time | 1 entry |
| (5) all four can be false at the same time | 1 entry |

Total: 16 entries

The 16 binary propositions may be taken to represent mental operations using binary logical connectives such as implication, disjunction, equivalence, etc. Since any one of these can be negated independently it is convenient to regard negation as an additional operation and this forms the basis for a further 16 items in the series.

In the game p is represented by Butch, saying, "Yes, I did rob the bank." $\bar{p}$ by "No, I did not rob the bank." q by Slim saying, "Yes, I did rob the bank." $\bar{q}$ by "No, I did not rob the bank." Thus, Card 1 represents $(p \cdot q)$, Card 2 $(p \cdot \bar{q})$, Card 3 $(\bar{p} \cdot q)$ and Card 4 $(\bar{p} \cdot \bar{q})$.

The process of adapting the combinatorial for the game is best illustrated by Tables 1 and 2 where a general and symbolic description of the B and S items is given. The absence of two of the 16 binary propositions is to be noted: "Complete Affirmation" (when all four compound propositions are true) and "Complete Negation" (when all four compound propositions are false).

TABLE 1
GENERAL AND SYMBOLIC DESCRIPTION OF "BUTCH AND SLIM" ITEMS IN CONDITION A—
WHERE BUTCH IS TELLING THE TRUTH.

Q. No.	Statement	Cards correct	Symbolic description of correct cards	Description of operation
1	Slim and I robbed the bank together	1	$(p.q)$	Conjunction $(p.q)$
2	I robbed the bank on my own	2	$(p.\bar{q})$	Non-implication $(p.\bar{q})$
3	I am certain Slim did not rob the bank	2, 4	$(p.\bar{q}) (\bar{p}.q)$	Negation of q $\bar{q} [p]$
4	I robbed the bank but I am not saying whether Slim robbed the bank with me	1, 2	$(p.q) (p.\bar{q})$	Affirmation of p $p [q]$
5	At least one of us robbed the bank .	1, 2, 3	$(p.q) (p.\bar{q}) (\bar{p}.q)$	Disjunction $(p \vee q)$
6	I certainly did not rob the bank....	3, 4	$(\bar{p}.q) (\bar{p}.\bar{q})$	Negation of p $\bar{p} [q]$
7	I am sure that Slim robbed the bank	1, 3	$(p.q) (\bar{p}.q)$	Affirmation of q $q [p]$
8	We could not have robbed the bank together	2, 3, 4	$(p.\bar{q}) (\bar{p}.q) (\bar{p}.\bar{q})$	Incompatibility (p/q)
9	Neither of us robbed the bank	4	$(\bar{p}.\bar{q})$	Conjunctive Negation $(\bar{p}.\bar{q})$
10	Only one of us robbed the bank....	2, 3	$(p.\bar{q}) (\bar{p}.q)$	Exclusion $(p \vee q)$
11	Slim robbed the bank on his own ..	3	$(\bar{p}.q)$	Inverse Non-Implication $(q \supset \bar{p})$
12	If we did rob the bank we did it together	1, 4	$(p.q) (\bar{p}.\bar{q})$	Equivalence $(p = q)$
13	If Slim did not rob the bank I robbed it	1, 2, 3	$(p.q) (p.\bar{q}) (\bar{p}.q)$	Disjunction $(p \vee q)$
14	If I robbed the bank, Slim robbed the bank	1, 3, 4	$(p.q) (\bar{p}.q) (\bar{p}.\bar{q})$	Implication $(p \supset q)$
15	If I did not rob the bank, Slim did not rob it	1, 2, 4	$(p.q) (p.\bar{q}) (\bar{p}.\bar{q})$	Inverse implication $(p \subset q)$
16	If I did rob the bank, Slim did not rob it	2, 3, 4	$(p.\bar{q}) (\bar{p}.q) (\bar{p}.\bar{q})$	Incompatibility (p/q)

TABLE 2

GENERAL AND SYMBOLIC DESCRIPTION OF "BUTCH AND SLIM" ITEMS CONDITION B—WHERE BUTCH IS NOT TELLING THE TRUTH.

Q. No.	Statement	Cards correct	Symbolic description of correct cards	Description of operation
1	Slim and I robbed the bank together	2, 3, 4	$(p.\bar{q}) (\bar{p}.q) (\bar{p}.\bar{q})$	Incompatibility (p/q)
2	I robbed the bank on my own	1, 3, 4	$(p.q) (\bar{p}.q) (\bar{p}.\bar{q})$	Implication $(p \supset q)$
3	I am certain Slim did not rob the bank	1, 3	$(p.q) (\bar{p}.q)$	Affirmation of q q [p]
4	I robbed the bank but I am not saying whether Slim robbed the bank with me	3, 4	$(\bar{p}.q) (\bar{p}.\bar{q})$	Negation of p $\bar{p} [q]$
5	At least one of us robbed the bank	4	$(\bar{p}.\bar{q})$	Conjunctive Negation $(\bar{p}.\bar{q})$
6	I certainly did not rob the bank....	1, 2	$(p.q) (p.\bar{q})$	Affirmation of p p [q]
7	I am sure that Slim robbed the bank	2, 4	$(p.\bar{q}) (\bar{p}.\bar{q})$	Negation of q $\bar{q} [p]$
8	We could not have robbed the bank together	1	$(p.q)$	Conjunction $(p.q)$
9	Neither of us robbed the bank	1, 2, 3	$(p.q) (p.\bar{q}) (\bar{p}.q)$	Disjunction $(p \vee q)$
10	Only one of us robbed the bank....	1, 4	$(p.q) (\bar{p}.\bar{q})$	Equivalence $(p = q)$
11	Slim robbed the bank on his own ..	1, 2, 4	$(p.q) (p.\bar{q}) (\bar{p}.\bar{q})$	Inverse Implication $(p \subset q)$
12	If we did rob the bank we did it together	2, 3	$(p.\bar{q}) (\bar{p}.q)$	Exclusion $(p \vee q)$
13	If Slim did not rob the bank I robbed it	4	$(\bar{p}.\bar{q})$	Conjunctive Negation $(\bar{p}.\bar{q})$
14	If I robbed the bank Slim robbed the bank	2	$(p.\bar{q})$	Non-Implication $(p.\bar{q})$
15	If I did not rob the bank, Slim did not rob it	3	$(\bar{p}.q)$	Inverse Non-Implication $(\bar{q} \supset \bar{p})$
16	If I did rob the bank, Slim did not rob it	1	$(p.q)$	Conjunction $(p.q)$

Instead of these are provided two items sampling Disjunction (statements 5 and 13, Table 3) and two sampling Incompatibility (statements 8 and 16, Table 3).

It is to be noted that since both affirmative and negative forms are used, the 32 items contain 12 pairs and 2 groups of 3 logically equivalent items. This was designed so as to allow useful comparisons at the analysis stage and is of obvious psycho-linguistic interest. The logically equivalent statements are assembled in Table 3 below.

TABLE 3
SYMBOLICALLY EQUIVALENT STATEMENTS IN "BUTCH AND SLIM."

Description of Operation	Affirmative	Negative
Conjunction.	Slim and I robbed the bank together.	We could not have robbed the bank together.
Non-Implication.	I robbed the bank on my own.	If I robbed the bank, Slim robbed the bank.
Negation of q.	I am certain Slim did not rob the bank.	I am sure that Slim robbed the bank.
Affirmation of p.	I robbed the bank but I am not saying whether Slim robbed the bank with me.	I certainly did not rob the bank.
Negation of p.	I certainly did not rob the bank.	I robbed the bank but I am not saying whether Slim robbed the bank with me.
Affirmation of q.	I am sure that Slim robbed the bank.	I am certain Slim did not rob the bank.
Conjunctive Negation.	Neither of us robbed the bank.	If Slim did not rob the bank, I robbed it. At least one of us robbed the bank.
Exclusion.	Only one of us robbed the bank.	If we did rob the bank we did it together.
Inverse Non-Implication.	Slim robbed the bank on his own.	If I did not rob the bank, Slim did not rob it.
Equivalence.	If we did rob the bank, we did it together.	Only one of us robbed the bank.
Implication.	If I robbed the bank, Slim robbed the bank.	I robbed the bank on my own.
Inverse Implication.	If I did not rob the bank, Slim did not rob it.	Slim robbed the bank on his own.
Disjunction.	At least one of us robbed the bank. If Slim did not rob the bank, I robbed it.	Neither of us robbed the bank.

It is also possible and instructive to describe B and S items in the language of the INRC group of higher order logical transformations. Take, for example, the statement of implication: "If I robbed the bank, Slim robbed the bank." This is, of course, the statement of *Identity*—I symbolised by $(p \supset q)$ and where the following are true: $(p \cdot q) \vee (\bar{p} \cdot q) \vee (\bar{p} \cdot \bar{q})$ (Cards 1, 3, 4). A statement representing the *Inversion* N of this would be "I robbed the bank on my own" $(\bar{p} \supset \bar{q})$ where only $(p \cdot \bar{q})$ (Card 2) is true. The *Reciprocal* R of the statement could be "If Slim robbed the bank, I robbed the bank" $(q \supset p)$ where $(p \cdot q) \vee (p \cdot \bar{q}) \vee (\bar{p} \cdot \bar{q})$ (Cards 1, 2, 4) are true. Finally, the *Correlative* C could be "Slim robbed the bank on his own" $(\bar{q} \supset \bar{p})$ where only $(\bar{p} \cdot q)$ (Card 3) is true.

From this it is easy to form the various combinations of the INRC group, e.g., $C=R$ N, $N=R$ C, etc. All the other statements could be analysed in this way and in fact the test situation is a very useful heuristic device for understanding the relationship between the Combinatorial and INRC Group.

The Development of Butch and Slim.

The early work upon the construction of a game of logic is described by Ward and Fitzpatrick (1970) and it is therefore not described in detail in the present account. After trying a number of approaches the work centred around a simple game called the "The TV Game" which was also based upon the combinatorial and which required the subject to assign cards representing the four compounds of p and q to a sort of truth table. However, for a number of reasons, which have been stated in the account cited above, it was felt that this particular approach possessed conceptual and practical limitations, and work was therefore abandoned in favour of Butch and Slim.

Experimental design for try-out.

The basic source of information is the design for the try-out of the experimental version of the BIS. This was designed to obtain a wide range of preliminary data as to item behaviour and included a sample stratified by:

- (a) *Age*, taken within one year intervals except below the age of four;
- (b) *Sex*, equal numbers of boys and girls;
- (c) *Geographical Location*, urban *versus* rural in the proportions found in the general population;
- (d) *Regional Grouping*, 10 areas of regional organisations adopted so as to provide roughly representative samples from each regional area;
- (e) *Socio-economic Class*, three broad groups in proportions suggested by Registrar-General's classification;
- (f) *Intelligence*, assessed by teacher as above average, average and below average.

Total BIS Sample = 272 (139 boys, 133 girls).

Additional Samples: 50 boys in 13-year age group;

84 subjects of various ages (51 girls, 33 boys).

The testing was carried out predominantly by the psychologists participating in the BIS try-out, by student educational psychologists and the writer. The number of subjects is given in Table 4.

RESULTS

The mean Affirmation and Negation scores at each of seven age levels are given in Table 4.

TABLE 4

MEANS AND STANDARD DEVIATIONS OF TOTAL AFFIRMATION AND NEGATION SCORES AT EACH OF SEVEN AGE LEVELS.

Total N=406.

Age Group	N	Total Score		Affirmation		Negation	
		X	SD	X	SD	X	SD
8	10	6.00	3.60	5.50	3.04	0.50	1.50
9	11	12.54	5.64	8.73	2.70	3.82	3.810
10	33	12.01	6.92	8.21	3.69	3.82	4.05
11	64	14.56	5.99	9.14	3.16	5.43	3.78
12	84	15.43	6.47	9.85	3.169	5.59	4.36
13	126	18.13	5.68	10.46	2.83	7.68	3.88
14	78	18.69	5.42	10.60	2.65	8.10	3.79

It may be observed that over the age range 10-14, the means show a reasonably consistent upward trend, total scores increasing with age in a linear fashion. However, it is clear that, from the point of view of discrimination, the Negation condition is by far the most promising, the Affirmation scores taking the form of a very shallow slope. The results more or less substantiate the choice of a Piagetian rationale for the items, the increase in total scores reflecting presumably the increasing use of elements in the combinatorial, with particular emphasis on the ability to think reversibly in the form of the Negation items. Thus, the convergence of the mean Affirmation and Negation scores may be taken as an indication of the growth of fully operational thinking.

Effects of experimental variables.

The effects of the experimental variables in the BIS try-out of B and S are described by Ward (1971) and it is not proposed to give this considerable body of detailed information. In summary it might be said that there was no firm evidence of a significant difference between sexes or geographical locations. The items discriminated strongly between intelligence levels at most age groups, there being also some evidence of a social class effect. It must be said that the latter was not unexpected owing to the complex linguistic nature of the items (Bernstein, 1960; Jensen, 1969). Unfortunately, there were insufficient subjects for a detailed study of these effects.

Specific Operations.

Table 5 shows the difficulty levels of each item or mental operation taken over the age range of the sample. These are of dual interest in that they demonstrate possible developmental trends in the responses to the items and also the comparative difficulty of logically equivalent items.

TABLE 5

FACILITY VALUES OF THIRTY ITEMS AT EACH OF SEVEN AGE GROUPS.
Total N=406.

Item No.	Age Group						
	8	9	10	11	12	13	14
3	40	55	47	66	70	83	82
4	30	63	64	74	73	74	72
5	30	45	41	52	53	61	58
6	30	72	61	78	75	92	98
7	30	63	56	62	79	80	80
8	00	55	47	41	50	57	51
9	60	91	75	95	98	91	99
10	50	91	64	86	90	93	93
11	60	72	72	77	83	70	85
12	10	27	28	28	46	60	55
13	00	10	09	16	19	18	22
14	00	10	15	16	14	18	19
15	00	10	09	18	15	13	14
16	00	10	12	20	15	20	14
17	00	55	22	36	49	58	60
18	00	27	31	42	46	57	63
19	10	36	31	55	57	64	74
20	10	17	34	53	53	49	62
21	00	36	12	44	27	44	54
22	10	27	38	60	59	81	82
23	00	36	41	39	57	80	81
24	10	36	28	48	46	53	63
25	10	36	34	24	49	66	70
26	00	36	41	33	50	64	62
27	00	17	15	16	34	32	32
28	00	10	06	21	29	31	40
29	00	00	06	12	09	20	18
30	00	10	03	07	09	16	16
31	00	00	03	10	09	16	19
32	00	00	06	07	13	23	18

In Table 5 can be seen the reasons for the relatively undramatic increase in total scores by age. There is little evidence of pronounced developmental trends on many of the items. Probably item 12 (equivalence) is the most promising of the more difficult items, the various items presented in conditional form being evidently too demanding for the vast majority of subjects. On this evidence the most useful items are the negation forms operating between 11 and 13, and, in terms of logical equivalence, it is also clear that the negated items are very much more difficult on the whole. However, there is some evidence of a learning effect which would affect the relative difficulty levels considerably. Over 70 subjects obtained scores on the negated items equal to or exceeding the Affirmation scores. For this reason the above facility values should be viewed with some caution.

Intercorrelations of items.

An analysis of the intercorrelations of items is an obvious and psychometrically essential source of information upon which to base decisions as to their redundancy. However, owing to the dichotomous nature of the data, difficulties exist over the choice of correlational techniques prior to factor

analysis. It was decided, therefore, to restrict analysis to a combined age group for which all the item facility values lay inside the 90-10 per cent cut-off points. For reasons of sample size a combined group, the 12-13-14 year group, from the BIS sample was used ($N=162$). The results of principal component analysis of the resultant data are given in Table 6.

TABLE 6

PRINCIPAL COMPONENT ANALYSIS OF INTERCORRELATIONS OF ITEMS OBTAINED FROM
12-13-14 GROUP DATA.
($N=162$)

Item No.									
3	-.279	.349	.139	.125	.443	-.173	-.026	-.210	.166
4	-.420	.228	.299	.237	.246	.284	.172	.257	-.057
5	-.392	.283	.135	.294	.213	.155	.058	.218	.226
6	-.424	.436	.155	.111	.157	.252	-.184	.015	-.333
7	-.530	.321	.105	.295	.115	.149	-.274	-.228	-.254
8	-.463	.227	.084	.350	-.106	.172	.017	-.360	-.011
9	-.393	.281	.322	-.276	-.045	-.154	.297	.078	-.041
10	-.413	.304	.305	-.012	.075	-.267	.123	.022	-.109
11	-.254	.123	.360	-.077	.135	-.282	.569	.092	-.280
12	-.491	-.010	.166	.197	.191	-.275	-.115	-.222	.205
13	-.404	-.256	.295	.322	-.185	.052	.079	-.101	.324
14	-.486	-.478	.333	.294	-.382	-.014	-.069	.013	-.086
15	-.468	-.386	.339	.344	-.249	.108	.015	-.020	.095
16	-.364	-.453	.311	.168	-.316	-.118	-.109	.344	-.102
17	-.510	.131	-.227	.000	-.037	-.438	-.211	.263	-.098
18	-.624	.108	-.134	.141	.046	-.175	-.140	.281	.097
19	-.546	.077	-.262	-.072	-.226	.030	-.028	.271	-.201
20	-.622	.238	-.319	.012	-.036	.122	.026	.172	.087
21	-.404	-.149	-.157	-.121	-.215	.031	.412	-.124	.236
22	-.543	.179	-.434	-.180	-.213	.224	-.002	.039	-.086
23	-.605	.232	-.376	.008	-.029	.222	-.149	.070	.120
24	-.421	-.090	-.130	-.195	.030	.476	.440	-.047	-.067
25	-.653	-.061	-.254	-.088	-.146	-.185	.021	-.223	-.121
26	-.627	.047	-.373	-.088	-.158	-.244	.049	-.268	.125
27	-.622	-.008	-.212	-.008	.023	-.230	.085	-.268	-.182
28	-.461	-.065	-.137	-.124	.292	-.045	.039	.260	.469
29	-.396	-.545	.037	-.237	.156	.091	-.132	-.093	-.037
30	-.420	-.512	.059	-.220	.342	.206	-.078	-.084	-.051
31	-.508	-.596	.080	-.218	.331	.054	-.088	-.028	-.085
32	-.388	-.552	.019	-.314	.295	-.062	-.083	.074	-.111
Latent Root	7.118	3.143	2.342	1.979	1.480	1.311	1.205	1.097	1.019
%-age Var.	22.244	9.821	7.319	6.184	4.624	4.908	3.766	3.427	3.185

Total Variance extracted = 64.669%.

It will be noted that nine factors greater than unity were extracted, all but the first being bipolar. Factor I has moderately high loadings from most items and could variously be interpreted as a difficulty factor, a general logic factor or a combinatorial factor. In most respects it complements facility and discrimination indices in giving high loadings for the negation items. Factor II appears to contrast the Implicatory type items with the others and certainly they do form a discrete group in many ways. Factor III probably reflects the two modes

of administration, Affirmation and Negation, and it may well be that further use of the test will confirm this factor. However, the rest of the analysis gives a rather confused picture and it was not considered necessary to rotate the factors or to carry out alternative analyses.

Psychometric Information.

(a) *Reliability.* KR20 coefficients were computed for five combined samples of the BIS group. These ranged from .861 to .907 with an estimate for the whole sample of .872. For a relatively unrefined instrument these may be considered satisfactory and would encourage the belief that at a later stage very high estimates of internal consistency could be obtained. However, it is likely that stability of measurement will be low and for this reason a set of parallel forms would be a most useful way of assessing reliability.

(b) *Validity.* Ward (1971) summarises preliminary data as to the validity of the items. Analysis of BIS try-out results provided some evidence in that B and S correlated with the unrefined versions of five sub-tests which may be held to sample the reasoning process and loaded substantially on the same general factor. A further analysis ($N=50$) disclosed high levels of correlations with Watson-Glaser Critical Thinking Test, the Primary Mental Abilities and the AH4. In a study of gifted children using the Affirmation items, Hitchfield (personal communication, 1970) found significantly high correlations between B and S and the Verbal and Performance Scales of the WISC. Indications of concurrent validity in the form of correlations with measures of attainment were also present ($N=238$).

Evaluation by Psychologists.

Using a four-point scale, psychologists taking part in the BIS try-out were asked to evaluate the items in terms of their ease of administration, clinical richness and ease of scoring, indicating on a four-point scale whether the items should be included in the test. On these three counts B and S was positively received, obtaining a medium to high rating. Eighteen psychologists offered comments upon the items. All agreed that the basic idea was sound, although four suggested that other means of sampling the combinatorial should have been used, e.g., circuit diagrams or Venn diagrams. Two-thirds considered that the instructional procedures were somewhat verbose. None offered possible improvements. Rather surprisingly, four voiced the opinion that introducing the element of truth and falsity was ethically wrong (this was taken up in the popular press at one time). Others mentioned conceptual difficulties for the administrator, excessive time required for administration and that probably the items were most suitable for older and more intelligent subjects.

Analyses of errors.

The work of Inhelder and Piaget (1958) and various replicatory studies indicate that in pre-adolescence and adolescence there is an increase both in the number of hypotheses that may be generated to aid in the solution of a problem and in their logical complexity. This is held to culminate in the emergence of the INRC Group with its system of fully reversible operations. Now B and S does not require the subject to produce hypotheses about a phenomenon but to test the truth value of propositions already supplied against a rule or logical condition. There is some evidence that in absolute terms the ability to do this improves with age; the question is, does this improvement in the overall level of response extend to the nature of the errors committed? From the beginning

of work on these items (Ward and Fitzpatrick, op. cit.) it was thought that a score based upon the number of correct card choices might be more discriminative than one based solely upon fully correct choices. For this reason those taking part in the try-out were required to record the subject's response in detail.

Designation of errors.

However, it was soon obvious that it was not possible to introduce a uniform system of categorising errors which would permit an elegant exact test such as that used by Peel (1967) in his logical game. Items may require one, two or three cards to be chosen for a correct solution and in the practical sense at least seven types of response can be made. Of these, it was considered that only three were sufficiently clear to warrant further analyses. These are:

(a) In the case of an item requiring two correct choices, the subject makes only one.

(b) In the case of an item requiring three correct choices, the subject gives only one.

(c) In the case of an item requiring three correct choices, the subject gives only two.

On the BIS sample data, therefore, an attempt was made to carry out an analysis of errors on each item. However, it was soon evident that it was possible to achieve this only with the Affirmation condition, as examiners frequently discontinued after the first two or three items of Negation. Before presenting these data it is to be observed that a record of absolute numbers would be somewhat meaningless. The higher the facility value, the lower the number of errors must be anyway, so that probably the most informative statistic is the proportion of total errors which are (a), (b) or (c), according to the nature of the item. These data are given in Table 7.

TABLE 7

INCIDENCE OF TYPE A, B AND C ERRORS EXPRESSED AS PERCENTAGES OF TOTAL ERRORS
ON 11 AFFIRMATION ITEMS. SEVEN AGE GROUPS.
(N=272)

Item		8	9	10	11	12	13	14
3	a	17	60	19	73	55	50	69
4	a	29	75	30	50	50	27	70
5	b	14	17	17	18	23	21	24
	c	28	50	22	26	35	47	52
6	a	42	66	18	15	10	50	66
7	a	42	50	15	49	37	36	54
8	b	30	40	29	30	33	20	48
	c	0	40	18	21	33	35	43
12	a	44	62	54	54	75	52	38
13	b	30	30	21	32	27	32	22
	c	10	30	7	25	42	19	22
14	b	30	20	23	29	24	14	25
	c	10	50	19	31	39	49	45
15	b	40	30	25	36	35	35	25
	c	0	30	18	21	38	39	48
16	b	40	20	22	38	35	22	21
	c	0	40	15	11	29	47	34

The results of the analysis were rather disappointing as from considerable experience of the items the writer had hoped for some evidence of a developmental trend. Even allowing for the limitations of the sample the patterns are extremely uneven with considerable fluctuations apparent. Type (a) responses do not follow any sort of trend. Type (b) and (c) errors are reciprocally tied in a sense, as while type (c) errors are increasing, type (b) are decreasing. On an exploratory basis this was expressed as a ratio ER.

$$ER = \frac{\text{Type (b) errors}}{\text{Type (c)}}$$

Here the assumption was that a linear trend in errors would be discernible if a decrease in the ratio obtained. The results of this analysis are given in Table 8 where it may be seen that there is no evidence of a consistent trend. However, with larger random samples over the age range 11 to 15, the results of this type of analysis might prove to be very interesting.

TABLE 8

RATIOS OF TYPE B TO TYPE C ERRORS IN TABLE 8 DATA. SEVEN AGE GROUPS.

Item	8	9	10	11	12	13	14
5	.50	.32	.79	.70	.65	.45	.53
8	30.00	1.00	1.61	1.43	1.00	.57	1.11
13	3.00	1.00	3.00	1.28	.64	1.69	1.00
14	3.00	.40	1.21	.93	.61	.28	.55
15	40.00	1.00	1.39	1.71	.92	.89	.52
16	40.00	.50	1.46	3.45	1.21	.47	.62

General comments on the errors observed.

Before going to a more detailed consideration of some of the mental operations sampled in Butch and Slim it is proposed to list a number of what the writer regards as principal sources of error. These are based upon experience with a large number of subjects and the comments of some of the psychologists taking part in the experiment.

(a) Failure to accept the logical task. This appears in various forms which are not confined to any one age group.

(b) Failure to treat each card as a compound proposition, e.g., responding to statement 11, "Slim robbed the bank on his own," the subject points to Slim on Card 1 and said, "That one, because he says 'yes'."

(c) Failure to assign a truth value to each card. Here the subject, despite having met two examples upon which two cards can be correct, persistently selects only one card. When questioned about this the subject usually said something like, "That's the only one that can be true." Having made an initial choice the rest of the array is apparently regarded as irrelevant.

(d) Failure to accept the existential truth of Butch's statement. This mainly involved justifying choices by saying that Butch was telling a lie, e.g., in response to statement 7, the subject said, "Cards 2 and 4 may be wrong because Butch is trying to get Slim into trouble."

(e) Failure to accept statements as true anyway. This type of general error seemed to involve elements of both (a) and (c). Thus, in response to statement 1, the subject might state that Butch is not telling a lie and that he probably did it but Slim is not telling the truth when he says he didn't do it (pointing to Card 2).

(f) Inclusion of extraneous material. This type of error was more frequently made by younger children. Often when pressed for an explanation of an obviously random choice, they would say something like, "Well there's these two burglars and they get caught and taken to the police station, and they are asked to confess and they tell lies and try to get each other into trouble." Occasionally, the extraneous material would take the form of a prejudice: "Well, you can't believe what criminals say, anyway."

(g) Inability to retain the logical requirements of the task. This was extremely striking in the case of the Negation items where many of the younger subjects did not seem to be able to retain the correct set towards a sequence of more than two or three. Thus, with increasing cognitive load the subject appeared to break down despite repetition of the task requirements.

Special mental operations.

With a view to investigating the sources of discriminative power in the items a number of detailed scrutinies of specific mental operations were carried out via subject's introspections during attempts to solve the problems.

Negation.

As might be expected most younger children had a very limited idea of the truth value of cards when the statement was in negated form. They knew that making a statement in the form of a lie meant that the statement was not true but could not generalise this to the Butch and Slim situation. Several variations upon this were observable:

(a) The subject adhered to his choice for the affirmation condition despite the change in instructions.

(b) On several occasions the subject made his affirmation choice then rejected it. For example, Alan, 9-years-old, in response to negated statement 3, selected Card 3, stared at it and then pushed to one side saying, "No, that can't be true if Butch is telling a lie; now that can be right if Butch is telling a lie—*nothing* if he is telling a lie" (quite firmly).

Alternatively, there is a recognition that something might be true but the subject is unable to say which card. For example, Joan, an intelligent 10-year-old, in reply to statement 1 negated, "Well, if Butch is telling a lie, this can't be true, so who did it?" She looked at all the cards in turn and finally selected Card 3. Asked to justify this she said, "Well, I suppose that if Butch didn't do it, Slim did."

(c) Partial solutions. Many 10- and 11-year-old children seemed to be making a partial adaptation by restating propositions in their own terms: this is well known in all studies of syllogistic reasoning (Henle, 1962; Donaldson 1963). For instance, Bill, a 10-year-old, coped successfully with statement 7 in affirmative form but could only manage a partial solution when the statement was negated: "'I am sure that Slim robbed the bank' means that Slim did not rob the bank because Butch was telling a lie" (points to Card 2 only). This occurred sufficiently often in the early stages of the research for the writer

to wonder if, despite difficulties over implicatory reasoning, the negated conditionals would not prove easier than under the affirmative presentation. The negation of an implication refers to the second term only so that if the subject achieves a partial solution in the affirmative there may well be a better chance of success on the negated condition. Thus, Sheila, a 13-year-old, produced a partial solution to statement 14, "I robbed the bank, Slim robbed the bank—this is correct." In the negated condition, she surprisingly arrives at, "I rob the bank. Slim robs the bank and that isn't true. So I rob the bank, Slim does not rob the bank" (pointing to Card 2 which is the correct answer).

(d) Short-cut strategies. These stemmed from the recognition that what was true under the affirmation condition was now false or what was then false was now true. As far as the writer could judge, the latter involved an extra mental operation, and led to better results. Two variants were found, the first of these being by far the most common. This consisted of taking the cards one at a time and finding the reciprocal of the affirmative correct choice. The second strategy, adopted by 12 older and more intelligent subjects, was superior in that it took in the four cards as a whole and appeared to possess a form of spatial component. Here the strategy was to disregard the Negation requirement initially and to re-establish the correct choices for the Affirmation condition. The cards were then pushed aside as being false and what was left must, therefore be true. Michael, an above average 14-year-old, epitomises this approach. After item 17 he said, "Oh, yes, what was true last time now becomes false and *vice versa*." Several subjects put out the cards in a symmetrical array and carried out a motor act of reciprocity to arrive at the correct cards. However, although these strategies led to rapid solutions they did not produce improved performance in most cases. The tendency was for subjects to concentrate upon their initial choices and to think no further about them. Therefore, if any Affirmation items were wrong, the corresponding items would be incorrect. Perhaps the strategy represents the INCR type of reasoning without the full underpinning of the combinatorial.

Disjunction.

Two forms of disjunction are presented in Butch and Slim; exclusion and non-exclusive disjunction. The former produces two logical equivalents among the items, the latter three:

Statement 10 (affirmative), exclusion.

Statement 12 (negative) negation of equivalence.

Statement 5 (affirmative) disjunction.

Statement 13 (affirmative) in conditional form.

Statement 9 negation of conjunctive negation.

Exclusion caused far less trouble than the other forms, although there was a tendency for younger children to produce illogical forms of inference. For example, Trevor, a 9-year-old, pointed to Card 3 saying, "Butch means Slim robbed it. He was trying to get him into trouble." Conversely, John a 10-year-old, said, "Butch means that he did it because he wants to save his friend from getting into trouble" (pointing to Card 3). Converted, the logical statement amounts to, "It is not the case that if we did rob the bank we did it together." Negating the second half of the proposition gives, "We did it alone, or perhaps only one of us did it" but leaves the question of Card 4, which was in fact, chosen many times and is, of course, incorrect.

Statement 5 was correctly attempted by a reasonable proportion of the sample and appeared to justify its psycho-linguistic form. Even so, some of the subjects questioned about interpreting it as one of exclusive rather than non-exclusive disjunction and did not really understand the question. Alan, 10-years-old, for instance, disregarded the "at least" and said, "One of us robbed the bank : could be Butch or Slim."

It was anticipated that statement 13 would be far more difficult and this proved to be the case. This statement contains the twin complexities of being couched in conditional form and containing the word "not," both of which have been shown to have marked effects upon information storage and reasoning processes (Wason and Jones, 1963) ; some older students recognised immediately that "not" heralded trouble.

Incompatibility.

The logical operation of incompatibility is represented by three statements : 8, 16 and the negation of the conjunctive statement 1. Although the first of these contained "not," it proved to be a more promising item psychometrically and in many ways similar in operation to the negation of statement 1. Statement 8 seemed to involve the assumption that if Butch and Slim did not rob the bank together, they did not rob it at all, e.g., Susan, 10-years-old, "They just didn't do it" (pointing to Card 4). A fair number reasoned like Joyce, 11-years-old, "That means that Butch did it on his own because Slim couldn't have helped him." Most errors, however, were made by seeing the statement as one of exclusion, e.g., John, 13-years-old, "Well they did it on their own : one of them did it." Several older subjects were unsure of what the correct answers were and commenced by finding out what they were not. Charles, for instance, 14-years-old, took Card 1 and said, "Well, it couldn't be that one for a start . . . could be 2 or 3, I suppose, because Butch and Slim aren't together . . . and Card 4 might be true as they aren't doing it together."

Statement 1, negated, was used as a teaching item and appeared to attract two interpretations of the negation regularly. The first of these was that if it was not true that Butch and Slim robbed the bank together, then they did not rob the bank. The second was that if they did not rob it together, then they robbed it on their own. Only older children saw that the two interpretations were not mutually exclusive.

By contrast, statement 16 was much more difficult owing to the psycho-linguistic complexity mentioned in the case of question 13. So few actually succeeded with the implicatory items that detailed comparison of the various forms would be pointless. However, the protocols of Gerald, 13-years-old, illustrated what amounted to a trivalent evaluation of the cards, "If I did not rob the bank, Slim did not rob it—Card 2 must be right (place to one side) . . . if I did, Slim did not . . . this can't be true (pushes Card 1 to another section of the table). Now about what 3 and 4? If I did it—I suppose either of these could be true if I didn't do it!"

Equivalence.

Set up in the form of verbal propositions, equivalence proved to be much harder than the work of Peel (1967) and Matalon (1962) might suggest, facility levels being rather low. Typically, subjects of all ages seem to ignore the "if," however much it was emphasised ; on having Card 4 pointed out to them, they were amused as if they had fallen for a verbal trick. Even so, a gratifyingly large minority saw the point of "if" very quickly, e.g., John, 10-years-old,

"If we did it we did it together so that's right (points to Card 1)—yes, but this is right, isn't it (points to Card 4) they may not have done it . . . If my dad says, 'If you go out you've got to take your brothers' . . . doesn't mean to say I have to go out, does it?" Some subjects, however, obtained the correct answer without being able to explain how, e.g., Elizabeth, 13-years-old, who said, "Well Card 1 is right and Cards 2 and 3 are wrong. I don't know about 4, but I think it must be right if 2 and 3 are wrong."

Implication.

For the present purpose all five conditional statements, i.e. (12-16), are taken as items requiring a knowledge of logical implication. This is of special theoretical interest since it may be considered as a prime indicator of the development of the INRC Group.

There can be no doubt that logical operations involving the form "if . . . then" are extremely difficult for subjects of all ages; Peel (op. cit.) has demonstrated how these logical connectives can acquire other connotations for children. Thus, a substantial number of subjects dropped the word "if" and proceeded from there, ignoring the experimenter's heavy emphasis of the word. These people usually managed one correct choice and then might select cards at random in the hope of obtaining clues from the examiner. Thus, Joe, 11-years-old, pointed to Card 1 in response to statement 14, "I robbed the bank, Slim robbed it . . . that is it." (Pointed to Card 1 and waited expectantly.) On being asked if any other cards could be true, he pointed to Card 2. When asked why, he replied, "I dunno . . . could be true." Alan, a below-average 15-years-old, surprised the writer by getting the first parts of statement 15 (inverse implication) correct. He pointed to Cards 2 and 4 and then after a time to Card 3, "I am looking for cards with 'not' on." Further questioning of certain subjects revealed that some apparently correct partial solutions were not really the product of a logical inference. Four of the five conditional statements require the perception of Card 4 being true. When, in fact, Card 4 was chosen, the enquiry revealed a parrot-like re-statement of the examiner's remarks on statement 12. Thus, for some subjects the word "if" acted as cue for the choice of Card 4.

A number of speculations might be entertained as to the components of the implication processes required by Butch and Slim. As for correct solutions in Inhelder and Piaget's experiments, the possession of the full combinatorial might seem to be crucial. A further important aspect of the cognitive processes might be the recognition of 'indeterminate' categories composed of ostensibly mutually contradictory responses. However, Johnson-Laird and Wason (1969) indicate the probable importance of negation. Certainly implication does seem to demand a complementary grasp of the negated statement. For this reason, an analysis of the components of implicatory reasoning requires an older, possibly intellectually above-average group of subjects who can report their introspections reliably. Whether or not Butch and Slim is suitable for such research in its present form may be open to doubt, as there are some difficulties over accepting the logical requirement of the task if the negated implication items are given without the benefit of the training experience on Affirmation items.

CONCLUSIONS

This aim of the research project described has been to construct a series of individually administered reasoning problems in the form of a logical game.

This has been subjected to fairly large-scale try-out and evaluation, and the data and experience thereby gained should enable some sort of a decision to be made as to the feasibility of the items. Such a decision will largely depend upon the answers to the following fundamental questions :

- (a) Does the procedure appear to be sound psychometrically ?
- (b) Does it fit into the proposed framework for the BIS ?
- (c) Is it practicable from the point of view of cost, administration, time, portability, etc. ?
- (d) Is there a need for substantial modification ?
- (e) Irrespective of the answers to (a), (b), (c) and (d), is the approach acceptable within the context of general developmental psychology ?
- (f) Does Butch and Slim possess growth potential as a research instrument ?

(a) The results of the try-out suggest that the Butch and Slim approach is reasonably sound. Taken as a group the items scale with age, do not show pronounced sex differences and clearly differentiate ability levels at most age groups. The procedure can yield a pool of discriminative items of varying difficulty levels from which selections can be made. Provisional estimates of reliability and the results of factor analysis indicate that with refinement it might be possible to construct a scale of high internal consistency.

Experience of the items with other BIS sub-scales and with other tests suggest promising levels of concurrent and congruent validity. Moreover, it is evident that the establishment of an explicit rationale will facilitate the construction of parallel item series, and should thereby lead to more precise formulations of content, predictive and construct validity. In the case of the latter, it must be stressed that Butch and Slim, a procedure developed originally from Piaget's theory of cognitive structures, apparently fits well into a factorial framework.

(b) The feasibility of the items remains to be established since full comparisons with other reasoning items have yet to be made. In particular, factor analysis of each sub-scale may exclude some of the more experimental items. From the clinical point of view, Butch and Slim appears to be moderately acceptable. Whether, if retained, it will merit inclusion in a 'core' test or whether it will belong to a supplementary scale will be a future psychometric decision. However, even at this point in the proceedings it is contended that the evidence favours the retention of some items as part of an 'oversize' standardisation test.

(c) These items are eminently practicable from the point of view of cost, ease of manufacture and portability. The matter of administration will be discussed in more detail later but the time expended per scorable point could be somewhat reduced. Then an item series shortened to half or two-thirds of the present length could yield up to 15 discriminative points and could be carried out within 9 to 12 minutes easily. This would compare very favourably with sub-scales of other individual tests.

(d) On the basis of the varied experience gained with Butch and Slim it has been possible to arrive at a number of modifications which should improve the procedure. A revised form has been the subject of further experimentation, Ward and Pearson (1972). This incorporates the following modifications :

- (1) The introductory procedure, considered by many to be excessively verbose, is reduced in length.

(2) The introductory 'teaching' items include examples of 1, 2 and 3 card responses (the 3 card response is not demonstrated in the present method).

(3) The relationship between the 'Butch' of the cards and the 'Butch' of the statement is clarified by alternating the statements between Butch and Slim.

(4) The cards merely show statements of "yes" and "no": the longer statements on the cards are not, in the light of subjective report, necessary.

(5) The form of each statement is standardised so as to cut out such phrases as "I am certain," "I certainly," "We could not have."

(6) A card upon which each statement is presented should be available to the subject: probably booklet form would be best.

(7) The number of items should be cut down to 20.

However, since the foregoing data were collected the items have been administered to many adults and older students. The majority of these accept the convention of the game but question the validity of the more difficult problems, considering that they require a training in logic for solution. A further objection is raised, mainly by mathematics and science students, to the logical content of the items. This centres around the process of negation in general and the negation of implicatory statements in particular. These issues occurred quite early in the development work (Ward and Fitzpatrick, 1970), and the "lie telling" format was accepted by intelligent subjects as a logical convention. Moreover, the writer had to anticipate the criticism that items which possess a dubious basis in axiomatic logic cannot be intrinsically sound. They can, of course, be empirically sound as demonstrated by try-out but the suspicion leads to at least two possible consequences. The first of these concerns the confidence and general attitude of the test administrator; the second, the degree of suspicion with which older subjects view the items. Psychologists who do not accept (or, in a few cases, understand) the logical constraints of the task tend to approach the task differently and this undoubtedly influences the learning which takes place. In the same way older subjects who reject the notion of lie telling do not attempt the more difficult items in a practical way.

(e) Judging by the preliminary interest aroused by these items, the choice of a dual factorial/developmental rationale is an attractive experimental prospect at the present time. However, the content validity and ultimate generalisability of the items are as yet largely unknown: they are only one of a great many possible ways of sampling deductive thinking and their place alongside other approaches such as Peel's game must be established. Moreover, the relationships between Butch and Slim and other forms of logical processes and scientific methodology remain undemonstrated: developmental psychologists await the advent of a really definitive study of the structure of formal operations. It is true that many workers have contributed small scale analyses of Piagetian tasks (Bart, 1971; Lovell and Butterworth, 1966; Vernon, 1969) but the full range of operations in the combinatorial has not been directly sampled. Butch and Slim together with a number of parallel forms might well allow a test of the uni-dimensionality of formal operations.

To date the items, in the unmodified form, have been or are the subject of nine researches of varying size and scope. However, it has been proposed elsewhere (Ward, 1970) that a possible use for the items is that of a criterion-referenced test, although the more interesting criteria might be those of single logical operations such as implication and disjunction. In the latter cases a

wide range of supplementary items would be required in the form of a sort of item pool or "bank" (Wood, 1968) for logical connectives. This approach could readily be developed within the context of extra BIS scales, as it involves very little variation of the basic method.

(f) Growth potential for the Butch and Slim format will, of course, depend to a large extent upon whether the items are included in the final version of the BIS, thereby participating in the vast amount of research of all kinds which the new scale will generate. However, irrespective of this, it seems to the writer that useful research studies are possible in many problem areas. The psycholinguistic aspect of reasoning could form the subject of researches in the Wason-Johnson-Laird tradition. These could be set up, via factorial designs, to afford considerable degrees of experimental control over such variables as:

- (1) Active *versus* passive statement content ;
- (2) Variation of form of negation ;
- (3) The effects of the position of NOT in a statement ;
- (4) Statement length and logical equivalence.

Definition of these variables would have obvious psychometric utility in that the main parameters of item difficulty would be available for advanced scaling procedures. Thus, in common with the Matrices and Induction Scales in particular, Butch and Slim would furnish a focal point for more fundamental psychometric work on the BIS (as opposed to the empirical work of validation and calibration).

The foregoing has attempted to describe a piece of creative test construction which commenced in a fairly perfunctory way and became progressively more interesting as the project went on. The basic aims of the exercise have been realised in that a range of items appropriate to the age groups concerned has been written and sufficient preliminary information supplied for a judgment of inclusion or exclusion to be made. However, at this stage it is not possible to record whether the saga of Butch and Slim will have a happy ending : the decision as to whether these characters become contemporary or historical figures will reside elsewhere.

ACKNOWLEDGMENT—I wish to thank the British Psychological Society for granting permission to use material from the British Intelligence Scale ; Mr. T. F. Fitzpatrick, School of Education, University of Manchester, and the many educational psychologists and students who have contributed data.

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RESEARCH NOTES

TOWARDS THE INTERPRETATION OF CHILDREN'S LIE SCALE SCORES

By D. S. FINLAYSON

(School of Education, University of Liverpool)

SUMMARY. The relationship between the JEPI lie scale and two measures of conformity was examined in groups of successful and unsuccessful boys in three secondary schools. The conformity measure in which the items made explicit reference to the need for compliant, approval-seeking behaviour showed consistently positive relationships across all groups, while the implicit measure did not. It was hypothesised further that, as a consequence of their differential experience of success, the groups would perceive the testing situation as representing different degrees of threat to them of which the correlation of the lie scale with the neuroticism scale might be a reflection. The range of correlation coefficients obtained was discussed in the light of data derived from a study investigating the boys' perception of their schools.

INTRODUCTION

A number of views have been put forward as a basis for interpreting lie scale scores in personality tests (Eysenck, Nias and Eysenck, 1971). According to one view they can be regarded as an estimate of the degree to which subjects completing the inventory are likely to 'fake' their responses. A second interpretation, associated with the social desirability of the items, regards lie scale scores as estimating the extent to which subjects are likely to conform to the social expectations of others. The work of Crowne and Marlowe (1964) hypothesises a need for social approval as the basis of such conformity. A third view is that high lie scores may be an indication of lack of insight into one's own behaviour: the responses given are honest but inaccurate. In this paper, the conformity hypothesis is examined by relating the lie scale scores of groups of secondary school boys to two measures of conformity.

A second aim of the paper is to explore further the use of the magnitude of the correlation between the lie and neuroticism scale scores as a measure of the motivation of the group to fake responses. Michaelis and Eysenck (1971) have demonstrated that the magnitude of this correlation is associated with the conditions under which the personality inventory is completed. When the correlation is of a high order, they maintain that this is an indication that the test situation provides strong motivation for 'faking good' to take place.

PROCEDURE

The sample of 310 boys to which the tests were given was drawn from one year group in each of three schools—a traditional grammar school with a long Oxford-Cambridge connection, a grammar school with a pronounced technical bias and the academic classes of a comprehensive school whose intake tended to be made up largely of 'borderline-zone' children in the 11+ procedure. Sub-groups of successful and unsuccessful boys from within each of the school year-group samples were selected on the basis of using the combined 11+ quotient scores of the total sample in each school separately to predict, by means of regression equations, their attainments in the first, second and third year school examinations. Their actual examination attainments, assessed by summing the standardised marks obtained in the main school subjects, were then compared with their predicted attainment. Where these either exceeded or fell below the predicted level by more than the probable error over the three examinations the boys were regarded as successful or unsuccessful, ability being controlled within each of the schools.

The conformity hypothesis was tested using two different measures of this characteristic. The first was the extraversion scale of the JEPI. According to Eysenckian theory (Eysenck, 1966) introverts would be expected to conform to social expectations more than extraverts, but there is no explicit reference in the items to the notion of conformity or to a need for social approval. The second measure of conformity was a scale derived from an instrument developed by Flanders (1960) to identify dependent-prone pupils in school situations. He defines a dependent-prone pupil as one concerned primarily with pleasing the teacher, and the items have as their themes positive and negative instances of willingness to seek help or affection or to manifest conformist, compliant and approval-seeking behaviour in relation to both adult and peer-group figures. The intention of this scale to assess conformity is thus much more obvious to subjects than is the case with the JEPI extraversion scale, and is linked to the approval motive hypothesis of Crowne and Marlowe. The reliability figure for this scale was .67, which is just adequate for use with group data.

The tests were administered in conditions which the experimenters endeavoured to make equally relaxed for all subjects; but, because the tests were given in school, and because the groups of pupils included those with experiences of success and unsuccessful, it was hypothesised that different groups would perceive the same test administration procedure as representing different degrees of threat to them. Some justification for this assumption is given elsewhere (Finlayson, 1970). In that paper it was reported how the same groups of boys as were used in this study perceived their schools. The findings of that earlier study will be incorporated in the discussion of the results section of this paper.

RESULTS

Table 1 shows the correlations of the lie scale scores with each of the other tests used.

TABLE 1

LIE SCALE PRODUCT MOMENT CORRELATIONS.

Groups	N	Extraversion	Dependent Proneness	Neuroticism
Grammar	156	-.102	.416**	-.394**
Successful	32	-.102	.459**	-.281
Unsuccessful	40	-.087	.224	-.518**
Gram. Tech.	84	-.138	.376**	-.215*
Successful	24	-.363	.472**	-.144
Unsuccessful	26	-.278	.342	-.160
Comprehensive	70	-.197	.452**	-.264*
Successful	21	.229	.660**	-.577
Unsuccessful	24	-.512**	.321	-.039

* $P < .05$ ** $P < .01$

Conformity Hypothesis.

With the exception of the successful group in the comprehensive school, introverts tend to have higher lie scores than extraverts, though the relationship only reaches significance in the unsuccessful group in the comprehensive school. There is, however, considerable variation in the magnitude of the relationship in the various groups, the lowest correlations being in the grammar school. This variation could be the result of chance factors given the small number involved, but it is of interest to note that the rank order of the correlations of the lie scale scores with extraversion reflects almost exactly the rank order of the correlations which the lie scale shows with neuroticism, the hypothesised index of perceived threat of the testing situation.

With dependent-proneness, there is a consistent tendency for dependent boys to have high lie scores. This tendency is significant at the 1 per cent level in the year groups as a whole. The degree of confidence in the relationship is consistently lower in the unsuccessful groups than in the successful groups where the correlations have their highest values. When the reliability of the dependent-proneness scale is taken into account (.67), the extent of the relationship between the two measures is seen to be very considerable indeed.

Thus, with regard to the conformity hypotheses, a fairly consistent pattern of results emerges which confirms that hypothesis. What is notable, however, is the markedly higher correlations which the lie scale has with the dependent-proneness measure than with introversion. In the former, as was pointed out, the content of the items made explicit to the subjects the intention of the scale to assess their conformist tendencies and concern for social approval.

Situational Index.

Inspection of the final column of Table 1 shows that neuroticism is negatively related to the lie scale in all schools and all groups. Yet there is considerable variation in the magnitude of the lie/neuroticism correlation amongst the various groups. Of the three schools, the grammar school groups show the highest correlations, while amongst the successful and unsuccessful groups, it is the successful boys in the comprehensive school and the unsuccessful boys in the grammar school who show the highest correlations, both over .5. Also notable is the near zero correlation for the unsuccessful group in the comprehensive school. This degree of variability amongst the groups suggests that the value of the lie/neuroticism correlation could well be subject to systematic influences.

It was suggested earlier that data from another study (Finlayson, *op cit.*) might offer some support to the notion that the magnitude of the correlations might be indicative of the degree to which the boys perceive the testing procedure as threatening to them. A very brief account of some of the results of that study will, therefore, be presented here by way of speculative comment on the present data.

One of the findings of the perception of the school study was that, of all the groups, it was the successful group in the comprehensive school which saw teachers as most authoritarian and least considerate. Comments from a teacher in the school indicated why this might indeed be the case. Given the borderline ability of the pupils, those who show academic promise are placed in the top streams which are 'pushed' to a degree not found in the other schools. It was this group, it will be recalled, which showed the highest lie/neuroticism correlation. The group which showed the lowest lie/neuroticism correlation was the unsuccessful boys in the same school. These boys tend to gravitate to the lower streams where the teaching is less bound to external syllabuses and when the teachers can modify their approach to suit the needs of the pupils. These tendencies are reflected in the relatively friendly social relationships which the boys perceived to exist. Because of perceiving their teachers to be pushing them harder than any of the other groups it seems a reasonable inference that the successful group in this school will also be highly motivated to fake good. With the unsuccessful group, on the other hand, as they perceive least pressure they would appear to have least motivation to lie.

In the grammar school, where the lie/neuroticism correlations are generally high, the perceived academic orientations of the pupils as reported in the perception of the school study were significantly higher than in the other two schools. Because of the high academic aspirations, therefore, it is reasonable to infer that there is a greater motivation to fake good in this school than in the others. For the unsuccessful boys in this school, conflict associated with the discrepancy between their actual academic performance and the level of expected achievement may be particularly acute—hence their high motivation to fake good. The data from the perception of the school study are thus consistent with the situation index data of this study.

Whilst it is appreciated that a discussion of the school situation as perceived by particular groups falls far short of an adequate validation of the use of lie/neuroticism

correlation values as a measure of perceived threat to the groups tested, it does provide encouragement to explore this notion further in a much more systematic way. As part of that work, in view of the correspondence between the situation index and the relationship between the lie scale and extraversion, clarification of the role of this latter variable in 'faking good' is necessary.

ACKNOWLEDGMENTS—The data for this study were collected as part of a larger project financed by the Department of Education and Science. The author, however, is entirely responsible for the views expressed.

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(Manuscript received 5th October, 1971)

THE DEVELOPMENT OF MORPHOLOGICAL RULES IN CHILDREN

By SUSAN SELBY

(University of Dundee)

SUMMARY. The present study made use of Berko's 'Wug Test' to investigate the development of morphological rules in children aged from 4 to 14. The results suggest that the main usefulness of this procedure should be between the ages of 4 and 12, approximately. Within this range, most of the rules tested show a steady improvement towards a ceiling value. The two exceptions are derivation and the use of the comparative and superlative which show a slower and later development.

INTRODUCTION

This study arose initially out of the testing of a group of pre-school children, some of whom had taken part in a pre-school programme designed to enhance their conceptual development. Since the only adult norms available were for a small group of American students, it was felt desirable to obtain British adult norms. Thereafter, further groups of children were tested, ranging in age from 3 years 6 months to 15 years 6 months.

The Wug Test, which uses nonsense words (and also a few proper English words) is designed to test for knowledge of morphological rules. From a study of the actual speech of young children, Berko (1958) concluded that the most promising parts of speech to examine were the plural and two possessives of the noun, the third person singular of the verb, the progressive and past tense, and the comparative and superlative of the adjective. Consequently, she devised a test in which the child was required to apply these rules to mainly unfamiliar (nonsense) words. The subject was presented with a series of picture cards representing the words and asked to complete a sentence, using the required word.

Children's responses were considered to be 'correct' if they corresponded with the responses given by an adult sample, consisting of 12 college graduates. A sample of pre-school and of first-grade children were then tested. It was found that while the children's replies were not always 'correct' they were orderly and consistent. No sex differences were found, but some differences were revealed between the pre-school children and the first-graders. Generally, these differences were in the direction of perfecting knowledge they already had, e.g., giving more nouns the correct plural ending, or more verbs the correct past tense ending. It was clear that young children do make use of morphological rules, though they have greater difficulty with some of them than with others: for instance, of the verb forms, the children's performance was best with the present progressive.

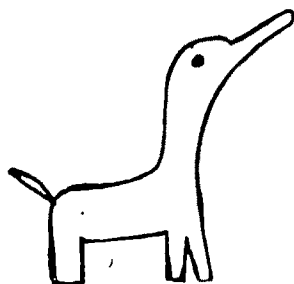
PLAN OF INVESTIGATION

(i) *Subjects and Materials.*

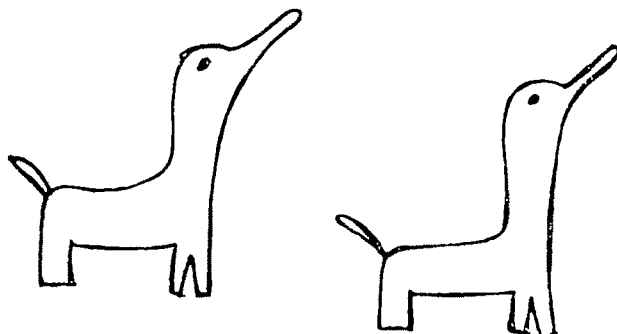
In the preparation of the test booklet, the wording outlined by Berko in her article was used. Illustrations were then produced (as black and white line drawings, with a little shading) to go with the sentences. Unlike Berko's procedure, the drawings were not coloured. The order and lay-out given by Berko were maintained. The full text of the test is given in the Appendix. Figure 1 shows the lay-out of a specimen item—in this case testing plurals. The number of items used to test each part of speech are shown in Table 1.

FIGURE 1

EXAMPLE OF TEST ITEM.



THIS IS A KAZH



NOW THERE IS ANOTHER ONE.

THERE ARE TWO OF THEM.

THERE ARE TWO

TABLE 1

NUMBER OF ITEMS USED TO TEST EACH PART OF SPEECH.

Part of Speech	No. of items
Plural	10
Progressive	1
Past Tense	8
Present Tense	2
Possessive	6
Comparative and Superlative	2
Derivatives	4
Total	33

Initially, two samples of subjects were tested—adults, and pre-school children (towards the end of their time in nursery school or playgroup). The adult sample ($N=50$) consisted of 25 post-graduate students of education at Dundee University, and 25 nursery nurses and teachers from Dundee nursery and primary schools. The sample of pre-school children ($N=163$) consisted of children in nursery schools, nursery classes and playgroups in Dundee. These children were tested shortly before leaving the pre-school establishment to enter primary school.

At a later date, further groups of children were tested—samples of 100 at each year group between the ages of 4 and 14.

(ii) *Procedure.*

The materials were presented to the subjects in the form of a booklet. Adults, and children over the age of 8, were tested in small groups and completed the test in written form. Children below the age of 8 were tested individually (as were any older children who had difficulty in reading or writing). In the case of individual administration, the tester showed the picture to the child and read out the text, requiring the child to fill in the missing word(s). Very few children failed to understand what was required, and these were omitted for the purposes of the present study. No introduction or explanation was used in the cases of individual administration, and the older children were simply told that they were to play a game in which they would fill in missing words.

RESULTS

(a) *Adult Sample.*

The children's performance was measured against replies given by adults. Any answer which was given by 15 per cent or more of the adults was considered to be acceptable. In some cases, this meant that two or more responses were permissible. The responses obtained together with the proportion of adults who gave each response are shown in Table 2. It can be seen that certain of the responses are not such as would be considered 'correct' by the grammarian, e.g., the -ed ending for the present tense. However, since the adult sample was drawn from people all of whom work with children, it was decided that these responses should be allowed as they presumably reflect the way in which some of the adults with whom young children come into contact speak. A weakness in this criterion is that it excludes the acceptability of imaginative, original responses,

TABLE 2
ADULT RESPONSES (PER CENT).

<i>Plurals</i> wugs (100) gutches (76) kazh (50) or kazhes (34) tors (88) luns (96) niz (36) or nizzes (52) cras (86) tass (18) or tassess (78) heafs (32) or heaves (60) glasses (98)	<i>Past Tense</i> spowed (94) ricked (86) motted (84) boddod (74) glang (30), glung (36) or glinged (26) bang (32), bung (22) or binged (32) rang (80) or rung (20) melted (100)
<i>Possessives</i> niz's (84) nizzes' (82) wug's (100) wugs' (84) bik's (98) biks' (80) or blks's (16)	<i>Progressive</i> zibbing (100)
<i>Comparative and Superlative</i> quirkier (76) quirkiest (90)	<i>Present Tense</i> nazzes (80) or nazzed (16) loodges (84) or loodged (16) <i>Derivatives</i> wuglet (52) or wuggle (26) wuggery (26) or wug-house (36) quirky (80) zibber (92)

(b) *Pre-school Sample.*

Since the pre-school sample ($N=163$) was originally tested as part of another study, various background data were available for these children and so their test scores were analysed by these variables to determine whether any of them were contributing significantly to variations in test scores.

Berko's finding that there is no difference between the performance of boys and girls on this test at pre-school level was confirmed. Furthermore, when the total sample was analysed by sex, no clear trend of sex differences was found: for some year groups boys obtained slightly higher scores than girls, and for others girls performed better.

However, there was found to be a consistent trend for scores to decrease with socio-economic class. Fathers' occupations were split into five classes, following the Registrar-General's Classification of Occupations. In view of the large differences obtained between social classes it was decided to select, at the various age-groups, samples of children weighted by socio-economic class. Consequently, the numbers of children in each socio-economic class were the proportions of the Scottish population in each class, as given by the Registrar-General (based on the 1966 Sample Census).

(c) *Parts of speech.*

The children's scores were computed for each part of speech, one mark being awarded for each correct answer within the appropriate category. Table 3 shows mean scores for each sample of children, converted to a percentage of 'correct' responses within each part of speech.

(d) *Norms*

Norms (for total scores) have been calculated and are available, split up into months of age, from the author.

TABLE 3
MEAN PERCENTAGE 'CORRECT' RESPONSES.

Age	Plurals	Past Tense	Possessives	Present Tense	Derivatives	Comparative and Superlative	Progressive
3-5-4-5	57	23	41	32	5	2	57
4-5-5-5	69	20	28	30	5	3	65
5-5-6-5	62	26	48	25	2	2	71
6-5-7-5	69	33	47	32	5	1	64
7-5-8-5	75	35	71	42	5	7	79
8-5-9-5	73	54	55	57	14	8	73
9-5-10-5	75	59	57	67	24	15	77
10-5-11-5	78	68	57	75	30	22	85
11-5-12-5	81	77	68	84	35	28	86
12-5-13-5	84	89	84	94	45	30	92
13-5-14-5	84	91	90	93	50	42	93
14-5-15-5	84	89	89	93	50	42	92

DISCUSSION AND CONCLUSIONS

It was found that the responses given by children of a particular age were orderly and consistent, even though 'incorrect,' e.g., young children, on the whole either did not attempt to form the comparative and superlative, or else they gave responses related to the pictures rather than the words, e.g., rather than attempt to form the comparative or superlative of the adjective 'quirky,' which referred to a dog covered with spots, they said the dog was 'spotty' or 'a dalmation.'

From Table 3, it can be seen that the test discriminates well between children of different ages. A closer look at the scores suggests that the test effectively reaches its ceiling at about the age of 12, i.e., roughly at the time of transfer from primary to secondary education. At the other end of the age-range, the test still appears to discriminate satisfactorily for 4-year-olds, although it would seem inadvisable to use the test below the age of about 4 (the youngest children included in the present study were aged 3 years 6 months).

Berko found that the main morphological rules are present in the child before school entry and that what is happening in this field during the early school years, and beyond, is a gradual refinement of skills which were already available. The present study suggests that, of the rules tested, *some* morphological rules are already well developed in the pre-schooler, that some are partially developed and that some are virtually non-existent before school entry and up to the age of about 10.

Table 3 shows that even the youngest children tested already possessed some of the morphological rules being considered—notably those for forming the plural of the noun and the progressive of the verb. It is also clear that the various rules progress at differing rates over the age-range considered. With the exception of the derivatives and of the comparative and superlative, most of the rules tested appear to reach a ceiling at about the age of 12. But even adolescents of the age of 14 or 15 are still poor at deriving words and at forming the comparative and superlative.

Overall, the formation of the plural of the noun appears to be the best assimilated morphological rule covered in the present study. Children appear on the whole to be able to cope with this rule some time before school entry.

As far as verbs are concerned, the progressive seems to be understood well before either the present or the past tenses. Indeed, the progressive was often used to form a past tense, e.g., "he was motting," instead of "he motted," and sometimes in place of the present tense e.g., "he (is) nazzing," instead of "he nazzes." This confirms Berko's findings with regard to verbs.

The present tense shows an unexpectedly poor performance, especially as younger children speak largely in the present. The rather unusual -ed ending given for the present tense by 16 per cent of the adults suggests that the fault may lie in the wording of the question: "This is a man who knows how to loodge. He is loodging. He does it every day. Every day he . . ." Indeed, if one considers this, the past -ed ending is not impossible and ungrammatical in the way that an -es ending would be to the questions designed to elicit the past tense ending.

Production of the possessives showed a steady improvement over the age-range considered, reaching a ceiling at about the bottom of the secondary school. A problem encountered on these items was that many of the younger children had a tendency to attribute possession of the hat to some outsider, and so their answer to "Whose hat is it?" might be "the man's," "the cowboy's," "the policeman's," etc. In future use of the test, it might be worth considering whether such answers should not, in fact, be accepted even though they are never given by adults in the standardisation sample.

Berko's findings that the formation of the comparative and superlative, and the derivation of words, were rules which young children did not have available were confirmed. As can be seen from the figures, these do not even reach a ceiling within the age-range considered.

In conclusion, it would seem that the Wug Test is one which is measuring a lawful aspect of language development in children, at least throughout the primary school years. Certain morphological rules appear to be well established before school entry; most show development towards a ceiling at about the age of 12; some show slow development and do not reach their ceiling even by the age of 14.

ACKNOWLEDGMENTS—This research was supported by a grant from the Social Science Research Council and the Scottish Education Department, under the general direction of Dr. T. R. Lee and Mr. A. Milne (later replaced by Mr. C. Morrison).

The author is grateful to the following, without whose aid the study would not have been possible: to Miss S. Early for the drawings used in the test, to Mr. L. Hodges for assistance with testing and to the Dundee schools which made children available for testing.

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(Manuscript received 27th January, 1972)

APPENDIX

WORDING OF THE 'WUG TEST'

1. *Plural*. One bird-like animal, then two. "This is a wug. Now there is another one. There are two of them. There are two"
2. *Plural*. One bird, then two. "This is a gutch. Now there is another one. There are two of them. There are two"
3. *Past tense*. Man with a steaming pitcher on his head. "This is a man who knows how to spow. He is spowing. He did the same thing yesterday. What did he do yesterday? Yesterday he"
4. *Plural*. One animal, then two. "This is a kazh. Now there is another one. There are two of them. There are two"
5. *Past tense*. Man swinging an object. "This is a man who knows how to rick. He is ricking. He did the same thing yesterday. What did he do yesterday? Yesterday he"

6. *Diminutive and compounded or derived word.* One animal, then a miniscule animal. "This is a wug. This is a very tiny wug. What would you call a very tiny wug? This wug lives in a house. What would you call a house that a wug lives in?"
7. *Plural.* One animal, then two. "This is a tor. Now there is another one. There are two of them. There are two"
8. *Derived adjective.* Dog covered with irregular spots. "This is a dog with quirks on him. He is all covered with quirks. What kind of dog is he? He is a dog."
9. *Plural.* One flower, then two. "This is a lun. Now there is another one. There are two of them. There are two"
10. *Plural.* One animal, then two. "This is a niz. Now there is another one. There are two of them. There are two"
11. *Past tense.* Man doing calisthenics. "This is a man who knows how to mot. He is motting. He did the same thing yesterday. What did he do yesterday? Yesterday he"
12. *Plural.* One bird, then two. "This is a cra. Now there is another one. There are two of them. There are two"
13. *Plural.* One animal, then two. "This is a tass. Now there is another one. There are two of them. There are two"
14. *Past tense.* Man dangling an object on a string. "This is a man who knows how to bod. He is boddng. He did the same thing yesterday. What did he do yesterday? Yesterday he....."
15. *Third person singular.* Man shaking an object. "This is a man who knows how to naz. He is nazzing. He does it every day. Every day he"
16. *Plural.* One insect, then two. "This is a heaf. Now there is another one. There are two of them. There are two"
17. *Plural.* One glass, then two. "This is a glass. Now there is another one. There are two of them. There are two....."
18. *Past tense.* Man exercising. "This is a man who knows how to gling. He is glinging. He did the same thing yesterday. What did he do yesterday? Yesterday he....."
19. *Third person singular.* Man holding an object. "This is a man who knows how to loodge. He is loodging. He does it every day. Every day he....."
20. *Past tense.* Man standing on the ceiling. "This is a man who knows how to bing. He is binging. He did the same thing yesterday. What did he do yesterday? Yesterday he....."
21. *Singular and plural possessive.* One animal wearing a hat, then two wearing hats. "This is a niz who owns a hat. Whose hat is it? It is the hat. Now there are two nizzes. They both own hats. Whose hats are they? They are the hats."
22. *Past tense.* A bell. "This is a bell that can ring. It is ringing. It did the same thing yesterday. What did it do yesterday? Yesterday it"
23. *Singular and plural possessive.* One animal wearing a hat, then two. "This is a wug who owns a hat. Whose hat is it? It is the hat. Now there are two wugs. They both own hats. Whose hats are they? They are the hats."
24. *Comparative and superlative of the adjective.* A dog with a few spots, one with several, and one with a great number. "This dog has quirks on him. This dog is quirky. This dog has more quirks on him. This dog is And this dog has even more quirks on him. This dog is the"
25. *Progressive and derived or compounded word.* Man balancing a ball on his nose. "This is a man who knows how to zib. What is he doing? He is What would you call a man whose job is to zib?"
26. *Past tense.* An ice cube, then a puddle of water. "This is an ice cube. Ice melts. It is melting. Now it is all gone. What happened to it? It....."
27. *Singular and plural possessive.* One animal wearing a hat, then two. "This is a bik who owns a hat. Whose hat is it? It is the hat. Now there are two biks. They both own hats. Whose hats are they? They are the..... hats."

PERSONAL CORRELATES OF BUREAUCRATIC ORIENTATION

BY L. COHEN

(School of Research in Education, University of Bradford)

AND R. HARRIS

• (Tranmere Park Primary School, Guiseley)

SUMMARY. This study is concerned with correlates of bureaucratic orientation among 10 to 11-year-old boys and girls. 86 children in three primary school classrooms completed the School Environment Preference Schedule (Gordon, 1971a) together with other personality and attitudinal measures. Bureaucratic orientation as measured by SEPS was found to correlate significantly with dogmatism, conservatism, neuroticism, and extraversion. The findings provide further validation data in respect of the SEPS.

INTRODUCTION

Bureaucratic personalities, by-products of the increasingly rationalised organisation of business and industrial enterprises, have attracted the attention of social scientists since Weber's (1946) classical analysis of the bureaucratic organisation. People who function best in bureaucratic work environments have been characterised as "methodical, prudent, disciplined" (Merton, 1940), readily acquiescing to the authority of their superiors and finding security in conforming to the rules that regulate their daily work.

More recently Gordon (1971a, 1971b) has proposed that children in school settings may vary in terms of their *bureaucratic orientations*. Gordon's School Environment Preference Schedule (SEPS) has been developed to identify those pupils who desire to comply with the directives of teachers, who seek the security that is afforded by adherence to school rules and regulations, and who exhibit the need to identify closely with their particular institutions (Gordon, 1971). In validating the SEPS, Gordon reports substantial support for the proposition that children scoring high on *bureaucratic orientation* have more favourable attitudes toward formal, traditional school environments than their fellow-pupils scoring low (Gordon, 1971).

The present study, employing an anglicised version of the SEPS in three mixed fourth-year primary classrooms was designed to determine (i) whether relationships existed between *bureaucratic orientation* and other selected personal variables (taken both singly and in combination), and (ii) to provide further validation data for the SEPS.

MEASURES

(1) *School Environment Preference Schedule.*

The criterion measure (SEPS) is a 24-item scale in Likert form. Pupils indicated the strength of their agreement or disagreement ('strongly agree,' 'agree,' 'undecided,' 'disagree,' 'strongly disagree') with statements such as "One of the most important reasons for being in school is to learn how to obey and follow rules," "Older people are in the best position to make important decisions for young people," and "It is foolish to question the judgment of a teacher in the subject he is teaching." Test re-test reliability coefficients from .62 to .75 are reported for the SEPS. High scores are indicative of bureaucratic orientation. Anglicising the SEPS involved only two minor changes of words.

(2) *Open-minded or closed-minded.*

An elementary school form of the adult Rokeach Dogmatism scale (Rokeach, 1960), developed for use with younger children, was used to obtain measures of the openness or closedness of pupils' belief systems (Figart, 1965). The Figart scale consists of 50 statements such as, "It is not good to read books that get your thoughts

about things mixed up," "We are going against our own side if we listen to what the other side says," and "We have a good way of running our country. Even so, it would be better if we let only clever people do it." Pupils indicated on a three interval response scale to what extent each statement accorded with what they themselves believed. Split-half reliability coefficients ranging from .59 to .73 are reported for the Figart scale. High scores reflect closed-mindedness.

(3) *Divergent Thinking Ability*

One non-verbal test ('circles') and two verbal tests ('consequences' and 'use of things'), originally developed by Getzels and Jackson (1962) and Torrance (1962) and subsequently modified for use with British children by Child (1968), were used as measures of divergent thinking ability. High scores on these tests "indicating a lack of anxiety about non-conformist responses (are held to be) a necessary but not sufficient condition for creative work" (Haddon and Lytton, 1968). Divergers score high on all tests.

(4) *The Children's Conservatism Scale.*

A modified form of the Conservatism Scale (Wilson and Patterson, 1968) adapted for use with children (Insel and Wilson, 1971) was used to explore the general factor of *conservatism* which, it has been argued, underpins a wide range of social attitudes including those related to punishment, religion, sexual mores, art, and political affiliations (Wilson, 1970). Children responded to a 50-item scale indicating which statements they favoured or believed in, by circling 'yes', 'no' or 'absolutely uncertain.' The items include statements such as 'whipping criminals,' 'saying prayers,' 'nude bathing,' 'modern art,' and 'the Queen.' A split-half reliability coefficient of .89 is reported for the Children's Conservatism Scale (Insel and Wilson, 1971). High scores indicate conservatism.

(5) *Extraversion-Introversion, Neuroticism-Stability.*

Measures of pupils' extraversion-introversion, and neuroticism-stability were obtained from the 64-item New Junior Maudsley Inventory (Furneaux and Gibson, 1966). High scores on the E scale reflect the outgoing, sociable individual ("I like to be in school plays," "I get the boys and girls together for parties, clubs and teams"); high scores on the N scale are indicative of anxiety and emotional instability ("I worry about the little mistakes I make," "I often feel sad for no reason at all").

ADMINISTRATION OF THE TEST MATERIALS

86 primary school pupils comprising three fourth-year classes in one junior school completed the battery of test materials. On three separate days, a trained tester visited each classroom to administer the schedules. Children were assured of anonymity, all questionnaires being precoded and collected immediately after completion. Conditions in each of the three classrooms were standardised in respect of the form of instructions given to the pupils, the sections of the various tests that were read aloud to them, and the spacing of the actual testing programme throughout the school's working day.

RESULTS

(1) *Correlates of bureaucratic orientation (total sample).*

Table 1 shows *bureaucratic orientation* (SEPS) to be significantly associated with *closed-mindedness*, *conservatism*, *extraversion* and *neuroticism*.

A multiple correlation coefficient (R_m) was computed between the criterion SEPS (variable 1) and the four predictor variables, *closed-mindedness* (variable 2), *conservatism* (variable 6), *extraversion* (variable 7), and *neuroticism* (variable 8).

55 per cent of the variance in pupils' bureaucratic orientations was accounted for by predictor variables (2), (6), (7) and (8).

TABLE 1

INTERCORRELATIONS BETWEEN THE CRITERION (SEPS) AND SELECTED PERSONAL VARIABLES. (Boys and Girls N=86).

VARIABLES	VARIABLES						
	2	3	4	5	6	7	8
1. SEPS	.69	-.20	-.08	-.17	.56	.40	.40
2. Open-closed mindedness		-.13	-.04	-.16	.50	.50	.52
3. Divergent Thinking 'circles'			.35	.42	-.10	-.08	-.21
4. Divergent Thinking 'consequences'				.56	-.03	.21	-.05
5. Divergent Thinking 'use of things'					-.04	-.04	-.17
6. Children's Conservatism Scale....						.06	.23
7. Extraversion-Introversion							.24
8. Neuroticism-Stability							

Significance levels: $r = .21$ $P < .05$; $r = .28$ $P < .01$.

(2) Sex differences.

Table 2 shows that when the total sample was dichotomised by sex, girls as compared with boys were found to be more *bureaucratically-oriented*, more *conservative*, and better performers on the two verbal tests of *divergent thinking ability*.

TABLE 2

COMPARISON OF BOYS' AND GIRLS' SCORES ON THE CRITERION (SEPS) AND ON SELECTED PERSONAL VARIABLES.

Variable	Boys (n=41)		Girls (n=45)		t	P
	Mean	SD	Mean	SD		
SEPS	27.97	8.50	33.86	5.46	3.86	.001
Open-closed mindedness	108.51	26.54	116.20	28.18	1.30	NS
Divergent Thinking 'circles'	32.51	13.76	33.22	16.46	0.22	NS
Divergent Thinking 'consequences'	6.82	3.26	8.33	2.81	2.30	.05
Divergent Thinking 'uses'	9.58	4.74	11.95	4.47	2.38	.05
Conservatism	38.04	15.81	48.04	6.77	3.87	.001
Extraversion	11.12	4.07	12.46	2.49	1.86	NS
Neuroticism	9.24	3.72	10.40	3.15	1.56	NS

Table 3 shows intercorrelations between the criterion (SEPS) and other personal variables, treating boys and girls separately. Multiple correlation coefficients were computed for these two sub-samples from those predictor variables identified as significantly associated with the criterion.

(3) Predicting bureaucratic orientation (boys).

A multiple correlation coefficient (R_m) was computed between the criterion SEPS (variable 1) and the five predictor variables, *closed-mindedness* (variable 2), *divergent thinking 'use of things'* (variable 5), *conservatism* (variable 6), *extraversion* (variable 7) and *neuroticism* (variable 8).

63 per cent of the variance in boys' bureaucratic orientations was accounted for by predictor variables (2), (5), (6), (7) and (8).

TABLE 3

INTERCORRELATIONS BETWEEN THE CRITERION (SEPS) AND SELECTED PERSONAL VARIABLES (Boys N=41, Girls N=45).

GIRLS (N=45)

VARIABLES	VARIABLES							
	1	2	3	4	5	6	7	8
1. SEPS	—	.55	-.30	-.28	-.16	.33	.16	.13
2. Open-closed mindedness	.73	—	-.23	-.21	-.11	.20	.27	.34
3. Divergent Thinking 'circles'	-.18	-.14	—	.33	.46	-.03	-.20	-.15
4. Divergent Thinking 'consequences'	-.13	-.08	.39	—	.57	-.20	-.06	.07
5. Divergent Thinking 'use of things'	-.39	-.29	.39	.50	—	.03	-.29	-.04
6. Children's Conservatism Scale	.54	.52	-.19	-.12	-.25	—	-.20	.19
7. Extraversion-Introversion	.44	.54	.00	.31	.03	.03	—	.08
8. Neuroticism-Stability	.51	.61	-.28	-.23	-.38	.19	.30	—

Boys (N=41)

Significance levels: Boys $r = .30$ $P < .05$; $r = .39$ $P < .01$. Girls $r = .29$ $P < .05$; $r = .37$ $P < .01$.

(4) *Predicting bureaucratic orientation (girls).*

A multiple correlation coefficient (R_m) was computed between the criterion SEPS (variable 1) and the three predictor variables, *closed-mindedness*, (variable 2), *divergent thinking 'circles'* (variable 3), and *conservatism* (variable 6).

38 per cent of the variance in girls' bureaucratic orientations was accounted for by predictor variables (2), (3) and (6).

VALIDATION OF THE SEPS

Correlates of bureaucratic orientation: (a) closed-mindedness.

The significant positive correlations between bureaucratic orientation and closed-mindedness both in the total sample (.69) and in the separate analyses of the boys' (.73) and girls' (.55) data are in line with what theoretically would be the expected pattern of association between these two variables. The relationships found in the present study are stronger than those shown by Gordon (1971) who used the adult form of the dogmatism scale (Rokeach, 1960) in conjunction with the SEPS with high school students and reported correlations ranging from .39 to .59.

(b) *Conservatism.*

Similarly, the significant positive association between conservatism and bureaucratic orientation (.56) is what might be expected where *conservatism* represents a tendency to reject the new or novel in favour of the security afforded by the well-tried and the conventional, and *bureaucratic orientation* is represented as *conformity* and *uncriticalness* in two of the four sub-scales constituting the SEPS.

(c) *Transcultural validation.*

Gordon (1971) observes that a decrease in bureaucratic orientation with age appears to be a transcultural phenomenon, citing studies which have employed the SEPS in Japanese and Indian settings to support his contention. Whilst we have no data (as yet) in respect of bureaucratic orientations of older boys and girls in secondary schools, our data from primary school classrooms (equivalent to 6th grade elementary classes in the USA) largely fit in with the monotonic decrease in SEPS scores which Gordon shows to occur between 7th and 12th grades.

(d) *Divergent thinking ability.*

Beta weights in respect of the divergent thinking test 'circles' in the girls' sample ($B = -.18$) and the divergent thinking test 'use of things' in the boys' sample ($B = -.18$) suggest that these measures may have some utility in increasing the accuracy of predictions of bureaucratic orientation based solely upon attitudinal data such as dogmatism and conservatism scales.

(e) *Extraversion and neuroticism.*

The significant positive correlation between extraversion and SEPS ($r = .40$) and neuroticism and SEPS ($r = .40$) in the total sample is largely due to the strong association between these two personality variables and SEPS in the boys' sample as compared with the girls'. Without replication of the finding in larger groups of primary school children drawn from different schools it is premature to attempt to account for the strength of the relationships in the boys' sample.

FUTURE RESEARCH

The School Environment Preference Schedule could prove of value to the researcher concerned with pupil achievement in different classroom environments and pupil adaptability to different teachers. The recent study of Weiss, Sales and Bode (1970), for example, showed the effects on pupil performance and attitudes of bringing together certain teacher and student personalities. The SEPS and its adult version (WEPS) offer similar possibilities to the researcher concerned with non-intellective correlates of pupil achievement.

ACKNOWLEDGMENT—We are grateful to Mr. Ian Rogers of James Graham College of Education, Leeds, for his kind assistance in the administration of the test materials.

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THE SOCIAL AND EMOTIONAL ADJUSTMENT OF DEAF AND
PARTIALLY DEAF CHILDREN

BY L. R. BOWYER AND J. GILLIES

(Department of Psychology, University of Glasgow)

SUMMARY. The hypothesis was investigated that partially deaf children have more social-emotional problems than severely deaf children, with the corollary that the policy of placing partially deaf children in ordinary schools might need to be reconsidered. 140 hearing impaired children were assessed for emotional adjustment by projective techniques and for social behaviour by teachers' ratings. No significant differences were found between the severely and the partially deaf. The coping of 40 partially deaf children in ordinary schools was studied in detail, with the conclusion that they were able to hold their own with hearing children when regular contact with specialist staff was maintained.

INTRODUCTION

A previous study (Bowyer *et al.*, 1963) had given tentative support to the view that partially deaf children, because of belonging neither with the deaf nor the hearing, have more social-emotional problems than those who are severely deaf. The question had been raised by members of a child guidance service who were concerned about the policy, consequent on improved hearing aids, of placing partially hearing children in schools for children with normal hearing, instead of educating them in special schools for the deaf. In order to have a more conclusive answer, a two-year investigation was undertaken in Glasgow, supported by the Scottish Council for Research in Education. The city operates a special department responsible both for children in special schools and also for handicapped individuals who are placed in ordinary schools; specialist teachers of a Reading and Speech Unit regularly visit each partially deaf child in the ordinary schools and keep the children and their parents in touch with the Unit.

DESIGN OF STUDY

Subjects.

140 children were selected as follows:

School A: All children attending Glasgow School for the Deaf, i.e., 18 boys and 22 girls, after wastage from those who left school before all tests were complete. (Total enrolment at start of testing: 53.)

In schools B and C all children were tested except for potential school leavers, to avoid wastage, and except for the younger children, because of our experience with school A that it was difficult to distinguish on our tests between maladjustment and immaturity. (Also, once our planned comparison number of 40 partially deaf was reached, we did not go back to test children who had been absent when their classmates were tested.) Thus:

School B: All available children, viz., 10 boys and 10 girls, aged 8-14 years, from Glasgow School for the Partially Deaf (a smaller school than A).

School C: All available partially deaf children, viz., 9 boys and 11 girls, aged 8-14 years, from a school which has both partially and severely deaf pupils. From this school 14 boys and 6 girls who are severely deaf were tested also, so that comparisons could be made within as well as between schools.

Schools D: 22 boys and 18 girls with impaired hearing who were attending ordinary schools in the city were selected for us by the Head of the Speech and Reading Unit, on our criterion "from as many different schools as possible." 37 schools were represented (not 40, because of siblings attending the same school, whom it seemed useful to include in our sample).

Thus, our population was:

School A: 40 severely deaf children.

School B: 20 partially deaf children.

School C: 20 partially deaf children.

School C: 20 severely deaf children.

Ordinary Schools D: 40 partially deaf children.

Test Procedure.

Four main kinds of assessment were used, viz., two non-verbal projective techniques to estimate emotional adjustment, and two ratings by teachers for social adjustment:

- (1) Lowenfeld's Mosaics.
- (2) Lowenfeld's "Worlds," with the Village Test (Züst, 1963) as an alternative.
- (3) Teachers' ratings for "ability to get on with other children."
- (4) Teachers' ratings for "ability to get on with adults."

Teachers were also asked to rate for ability to speak and to understand speech because it soon became apparent that ability to communicate was associated with scores for adjustment.

Details of administration of the projective techniques and a scoring method designed to give a five-point rating have been described elsewhere (Bowyer *et al.*, 1966). Teachers were asked to rate on a five-point scale (very good, good, moderate, poor, very poor) which was converted into scores to compare with the projective ratings, high scores representing good adjustment.

Since one purpose of the research was to find out what conditions might be associated with optimum functioning of partially deaf children in ordinary schools, it was necessary to get as detailed a picture as possible of these children, by means of:

- (a) Interviews with mothers, covering the areas of the Vineland Social Development Scale (self-help, occupations, communication) with the addition of organisations attended, and friendships.
- (b) Records furnished by the Reading and Speech Unit about hearing (audiograms, thresholds, loss, mode of functioning, problems with hearing aids, history of the deafness, and intelligence test results on WISC performance and the Snijders-Ooman test).
- (c) Information spontaneously offered by the director of the unit on helpful and unhelpful attitudes of parents and teachers.
- (d) Current school reports which included place in class in each subject, and observations on playground behaviour.

RESULTS

The means for the four main quantitative measures of adjustment are presented in Table 1, showing no significant differences between the deaf and the partially deaf.

TABLE 1
MEAN SCORES (WITH SDs) ON THE FOUR MAJOR ADJUSTMENT MEASURES.

		A		B		C				Various Ordinary Schools	
Hearing Loss		Severe		Partial		Severe		Partial		Partial	
Sex		M	F	M	F	M	F	M	F	M	F
Mosaics	M	2.94	4.00	3.80	3.10	3.43	3.33	3.56	3.55	3.50	3.56
	SD	(0.91)	(0.80)	(0.87)	(1.14)	(1.12)	(0.75)	(1.07)	(1.16)	(1.20)	(1.34)
World/	M	4.11	4.32	3.50	3.10	3.57	3.67	3.11	3.73	3.73	3.94
Village	SD	(0.57)	(0.76)	(0.95)	(0.54)	(0.73)	(0.47)	(1.10)	(0.62)	(0.91)	(1.03)
Adjustment M		4.56	4.32	2.80	4.10	4.57	4.33	4.33	5.00	4.23	4.28
to children	SD	(1.01)	(0.92)	(0.60)	(1.04)	(0.82)	(0.47)	(1.05)	(0.00)	(1.08)	(0.87)
Adjustment M		4.28	4.50	3.00	4.40	3.86	4.17	4.33	4.45	4.14	4.44
to adults	SD	(1.10)	(0.67)	(0.77)	(0.66)	(0.99)	(0.89)	(1.05)	(0.46)	(0.92)	(0.68)

Further analyses using the Kolmogorov-Smirnov test and phi-coefficients brought out the following:

- (1) Partially hearing children in School C were rated as better adjusted towards children than were partially hearing children in School B ($P < .01$). This may be connected with the encouragement of free movement and spontaneous conversation in the classroom in School C.
- (2) Ability to speak and "getting on well with adults" were significantly related ($P < .01$).
- (3) The understanding of speech was related to the ability to get on well *both* with children and adults ($P < .01$).

The two ratings (adjustment to adults and adjustment to children) were themselves significantly related ($P < .001$).

The qualitative data on the children seen at the Reading and Speech Unit led to further research which has been reported elsewhere (Gillies, 1968; Bowyer and Gilmour, 1970; Gilmour, 1971). The interviews based partly on the Vineland Maturity Scale showed that the varieties of activities of these partially hearing children, and their capacity for self-help and responsibility, were slightly above the norms of the Vineland Scale. (It came as a surprise to us that so many partially deaf children use the telephone, have piano lessons, go to dancing, enjoy listening to records, and are active members of organisations.)

DISCUSSION

The 40 children studied in detail who were attending schools for hearing children were coping with the same tasks as the non-handicapped children with no greater incidence of maladjustment than is found in an unselected school population. It is true that those found unable to cope would be educated in a special school but, nevertheless, there was a wide range of handicap and of ability (granted that these are hard to measure) among the partially deaf children coping successfully in ordinary schools. Measured IQs (on the WISC Performance and the Snijders-Ooman Scales) ranged from 70 to 125, and hearing loss for speech ranged from one case of very mild loss to one with no hearing for speech. The majority had a hearing loss of from 60 to 90 decibels, and were largely dependent on lip reading.

Our findings are in line with those of Cowen *et al.* (1961) and of Wenar (1954) who suggest that "the compensatory and restitutive mechanisms available to the handicapped child have been either underestimated or neglected." They differ from earlier results (e.g., Berlinsky, 1952), and also from the trend of our pilot study. We think that the explanation lies not only in what Hine (1970) has said about the decrease in the numbers of disturbed deaf children because of early ascertainment of the handicap and provision of hearing aids, together with training for parents in ways of developing language in their child, but also in the special service provided in the region of our main study. This extended to trying to modify unhelpful parental attitudes of over-protection or of pressure and to a continuing skilled interest in the children as individuals, with regular checking of each child's ability to use his hearing aid, and discussions with teachers in the ordinary schools. This kind of guidance, with contact at least once or twice a term, may be a necessary provision for partially deaf children who are to cope satisfactorily in ordinary schools for the hearing.

ACKNOWLEDGMENT—Our gratitude is due to the staff of the schools for the deaf, and specially to the late Mrs. Agnes Macmillan for her help and for the inspiration of her knowledge of the partially deaf children attending ordinary schools.

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(Manuscript received 18th February, 1972)

THE EFFECTS OF PROVIDING A WARNING ABOUT THE LIE SCALE IN A PERSONALITY INVENTORY

By D. K. B. NIAS

(Institute of Psychiatry, University of London)

SUMMARY. A new method of encouraging truthful answers to a questionnaire was investigated. 262 school pupils aged 12 and 13 years completed a revised version of the Junior Eysenck Personality Inventory. The scale was administered to half the group (controls) with the normal instructions while the others (experimental group) were, in addition, given information drawing attention to the existence of a 'lie' scale. The experimental group obtained a lower L score, and a higher score on psychoticism, and neuroticism (boys only); the effect on extraversion was not significant. The results from the experimental instructions were found to compare favourably with those from alternative 'correction' procedures, such as eliminating individuals with high L scores from the group analysis, or statistically adjusting scores on the basis of their correlation with L. It is thus suggested that the procedure of warning subjects about the presence of a 'lie' scale may prove useful as a standard practice in personality assessment.

INTRODUCTION

This study arose out of the need to find ways of increasing the truthfulness with which questionnaires are answered. While the effects of job-selection conditions (e.g., Michaelis and Eysenck, 1971), or asking subjects to deliberately 'fake good' (Eysenck, Syed and Eysenck, 1966) or 'fake bad' (Keehn, 1962), are well-known and fully appreciated, there is little evidence on the effects of more subtle procedures that might find general application in test administration. Whether questionnaires are completed anonymously or not has, in practice, been found to make little or no difference under normal (research) conditions (Kepes and True, 1967; Nias, 1972); this result is consistent with the hypothesis that subjects are already giving reasonably truthful answers under such conditions. There are indications, however, that increased truthfulness may be obtained by warning subjects about the presence of a 'lie' scale in the Eysenck Personality Inventory; an increase in truthfulness being indicated by decreased scores for L and increased scores for neuroticism (I. Montag, personal communication). This 'warning' technique has also been used in the context of asking subjects to try to avoid detection while deliberately simulating specified personality patterns (Braun and Gomez, 1966; Power and O'Donovan, 1969). The present experiment was designed to test the effects of the warning under more normal circumstances, which consisted of a typical questionnaire study with school pupils.

The usual method of dealing with the problem of lying is to take out of the main analysis those subjects with high L scores; this is done on the grounds that the L scale provides some indication of untruthfulness (Jensen, 1958; Gibson, 1962). Another method would be to statistically adjust the scale scores by computing what they might be for a given (reduced) L score; this procedure is possible for those scales that are correlated with L. The present experiment provided an opportunity of testing the effect of these retrospective measures against that of giving subjects advance warning of the L scale.

METHOD

A revised version of the Junior Eysenck Personality Inventory was employed; this revision involves 97 items designed to measure Psychoticism (P), Extraversion (E), Neuroticism (N), and a 'lie' factor (L). The sample consisted of 125 boys and 137 girls, aged 12 and 13 years, from the first and second year of a secondary modern school. The pupils were randomly assigned to two groups, balancing for sex, age and form. The study was introduced to the pupils with the explanation that it formed part of a research project concerned with individual differences. They were asked to fill in the spaces for name, age and sex, and the standard instructions as printed on the questionnaire were read aloud to them. The questionnaire was first administered to the control group in the usual manner, and then to the experimental group with the following verbal statement added to the instructions:

"With this questionnaire please answer all the questions as they apply to you as an individual. Sometimes people try to make themselves out to be better than they really are. Therefore, the questionnaire includes some items to check on this. For example, how would you answer the question, 'Have you ever told a lie'? . . . If you answered 'no' then this would suggest that you were not really being honest, because everyone tells a lie sometimes. So do try to be truthful in all your answers."

ANALYSIS AND RESULTS

The data were analysed separately for boys and girls in three main ways. First, a comparison was made between the control and experimental results. In order to provide a check that the random assignment to the two conditions was satisfactory, a comparison was made in terms of intelligence. This variable was chosen since it is known to be related to L scores (Eysenck, Nias and Eysenck, 1971), and IQs were already available in the school records. Means and standard deviations were computed for the IQ and personality scales (Table 1), together with their intercorrelations (Table 2). Internal consistency coefficients for each personality scale were also computed (Table 3).

TABLE 1

MEANS AND STANDARD DEVIATIONS FOR THE PERSONALITY SCALES AND I.Q.

		P	E	N	L	IQ
Boys						
Control	(N=61) ..	3.5 (2.5)	18.7 (3.0)	10.9 (4.6)	6.6 (4.2)	102 (12.3)
Experim.	(N=64) ..	4.5 (3.1)	17.9 (3.5)	13.3 (4.0)	4.9 (3.4)	103 (13.4)
Low Ls	(N=48)* ..	3.8 (2.5)	18.8 (2.8)	11.7 (4.3)	4.9 (2.5)	103 (11.1)
Adjusted	(N=61)† ..	3.7	18.9	11.4	4.9	
Girls						
Control	(N=69) ..	2.0 (2.0)	17.6 (3.2)	12.8 (4.6)	8.2 (4.5)	105 (12.2)
Experim.	(N=68) ..	2.9 (2.3)	17.2 (3.8)	13.9 (3.9)	5.3 (3.4)	105 (11.7)
Low Ls	(N=45)* ..	2.5 (2.0)	18.0 (3.4)	13.5 (4.2)	5.3 (2.2)	107 (11.5)
Adjusted	(N=69)† ..	2.5	17.9	13.7	5.3	

* Control group matched for L with experimental group by taking out the highest L scorers.

† Control group means statistically adjusted for the same L score as the experimental group.

TABLE 2

CORRELATIONS BETWEEN THE SCALES.

		PE	PN	PL	PIQ	EN	EL	EIQ	NL	NIQ	LIQ
Boys											
Control	(N=61)	·05	·39	·18	·13	·09	·11	·02	·27	·09	·34
Experim.	(N=64)	·00	·17	·08	·15	·23	·08	·10	·11	·11	·15
Girls											
Control	(N=69)	·03	·24	·45	·22	·05	·13	·06	·33	·10	·22
Experim.	(N=68)	·03	·33	·36	·19	·21	·25	·34	·35	·05	·20

TABLE 3

INTERNAL CONSISTENCY COEFFICIENTS FOR THE SCALES.

		P	E	N	L
Boys					
Control	(N=61)	·62	·63	·82	·83
Experim.	(N=64)	·72	·70	·77	·77
Girls					
Control	(N=69)	·61	·67	·83	·84
Experim.	(N=68)	·63	·76	·77	·77

Second, a comparison was made between the experimental results and the conventional method of eliminating subjects with high L scores from the analysis. 13 boys and 24 girls needed to be eliminated from the *control* condition in order to reduce the mean L score to the level of that in the experimental condition. The resulting data are presented in Table 1.

Third, a comparison was made between the experimental results and the effects of making a statistical adjustment based on each scale's relationship to L. A regression formula was applied to the *control* data using the L scale mean of the experimental condition. Thus, it was possible to compute revised means for P, E and N based on the lower L score. The formula, which is described by Edwards (1967), was as follows:

$$Y' = a + bX', \text{ where } a = \bar{Y} - b\bar{X} \text{ and } b = \frac{N\sum XY - \sum X \sum Y}{N\sum X^2 - (\sum X)^2}$$

N.B.—Y'=revised mean, and X'=assumed mean for L (from experimental results).

DISCUSSION

The IQ means presented in Table 1 provide confirmation that the experimental and control groups were comparable, at least on this variable. It may also be noted that the usual sex differences have emerged, such as the higher L scores for girls. The intercorrelations (Table 2) are similar to those obtained in a previous study with this inventory (Nias, 1972). The internal consistency coefficients (Table 3) are reasonably high, and may be taken to indicate that the children were responding in a meaningful fashion under both conditions of administration.

The effect of the additional instructions may be examined in several ways. Because the L, P and N scales are known, from previous studies, to be susceptible to 'desirability' response sets, we would hypothesise changes in these dimensions. A comparison between the two conditions does reveal a significantly lower L score in

the experimental condition for both boys and girls ($t=2.5$ and 4.1 respectively). Of more interest, however, especially in view of the experimental instructions that refer specifically to the L scale, are the significantly higher scores for P ($t=2.0$ and 2.4), and N in the case of boys ($t=3.2$ and 1.5). The means for E are slightly, but not significantly, lower in the experimental condition ($t=1.3$ and 0.7). The present findings are similar to those previously obtained with adults (I. Montag, personal communication).

Because the experimental condition appears to have produced *lower* scores for L and *higher* scores for P and N, the relationship between these two sets of scales should also have been affected. Thus, it may be noted that the negative correlation of L with P and with N (boys only) is lower, albeit only slightly, in the experimental condition. This result is consistent with Michaelis and Eysenck's (1971) evidence that a reduced correlation between L and N reflects a lower degree of motivation to 'fake good.'

The differences obtained by taking out the highest L scorers from the control group, while similar to those obtained with the experimental instructions, are in general not quite as marked. To provide a check on this conclusion, another analysis was carried out by matching the control and experimental groups throughout the L distribution. The L scores were grouped in sets of three (i.e., scores of 0, 1 and 2; 3, 4 and 5, etc.) for the purposes of this matching. It was necessary to take out 9 boys and 16 girls from the control condition, and 12 boys and 15 girls from the experimental condition. The resulting means are presented in Table 4. Again the experimental condition, having slightly higher scores on P and N (boys only), provides evidence consistent with the efficacy of the 'warning' technique over that of just taking out high L scorers.

TABLE 4
GROUPS MATCHED FOR L SCORE DISTRIBUTION.

			P	E	N	L	IQ
Boys							
Control	(N=52)	..	3.5 (2.4)	19.0 (2.8)	11.2 (4.5)	5.5 (3.3)	103 (11.0)
Experim.	(N=52)	..	4.6 (2.8)	17.9 (3.2)	13.3 (3.2)	5.5 (3.3)	103 (12.1)
GIRLS							
Control	(N=53)	..	2.3 (1.8)	17.7 (3.3)	13.3 (4.0)	6.3 (3.1)	106 (11.7)
Experim.	(N=53)	.	2.6 (1.8)	17.0 (3.1)	13.3 (3.7)	6.3 (3.2)	104 (10.4)

Likewise, the statistical adjustment to the control group means produced similar, but not quite as marked, differences as those provided by the experimental condition. The adjustment might have produced greater differences if the correlations with L were truly linear (as assumed by the formula used). Scattergrams were drawn to check that the distributions did, at least, approximate towards linearity rather than any other type of distribution.

From the results outlined in this paper it seems that the practice of explicitly drawing attention to the L scale does help reduce the amount of 'faking good.' The technique appears to be slightly more effective than eliminating high L scorers from the analysis, or statistically adjusting the means. It also has the advantage, over the former, of not reducing the number of subjects by eliminating a possibly interesting sub-group and, over the latter, of not being dependent on the scale's having a correlation, and one of known distribution, with L. Anyway, use of the technique does not, of course, preclude the application of other 'correction' procedures; nor does it preclude performing a more detailed analysis by dividing the sample into low, average and high L scorers as advocated by Gibson (1964). There would seem to be little risk in adopting the extra instruction as a standard approach in personality assessment.

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(Manuscript received 16th February, 1972)

A COMPARISON OF AH6 AG SCORES AND GCE EXAMINATIONS TAKEN AFTER AN INTERVAL OF ONE YEAR

By A. W. HEIM, K. P. WATTS AND V. SIMMONDS

(Psychological Laboratory, Cambridge)

SUMMARY. GCE O- and A-level examinations of boys from a public school were correlated with the AH6 AG test scores obtained a year earlier. The results suggest that the predictive value of AH6 for success in individual subjects is almost as high as when the examinations and testing were taken within a few weeks of each other. This is equally true for estimates of *overall* success in O- and A-level examinations where highly significant correlations are found.

INTRODUCTION

An earlier paper (Heim and Watts, 1972) described the performance on Test AH6 AG of boys from three public schools. All the boys in these schools took the test in the Summer of 1970. The scores of the fifth and sixth forms on this high-level test of reasoning were compared with the results of their GCE O-level and A-level examinations, taken in the same year as the test. This paper makes a similar comparison, for one of the schools only, of boys who were tested on AH6 AG at the same time but who—being respectively in the fourth and lower sixth forms when tested—sat the GCE examinations a year later.

GCE A-LEVEL EXAMINATIONS

(i) *Specific school subjects.*

As in the earlier paper, the grades gained in A-levels have been given numbers from 1 (grade A) to 7 (failure). As can be seen in Table 1, not all grades were awarded

in all examinations for the present sample. Those examinations taken by 10 or more boys for the first time are shown. Spearman's rho and one-tailed tests of significance have been used throughout.

Table 1 shows the correlations between AH6 score and GCE A-level results. The order of presentation of school subjects in the table is determined by the AH6 mean total score of the relevant candidates. These means are, throughout, lower than those given in Table 2 of the earlier paper since they represent the scores of boys who were a year younger when tested.

TABLE 1
COMPARISON OF AH6 AG SCORES WITH A-LEVEL EXAMINATIONS.

	Notes on Examination Grades Awarded	AH6 AG Mean Score			Spearman's rho Correlations			N
		V	N+D	Total	V	N+D	Total	
Physics	No B or F ..	15.9	16.5	32.5	.44	.14	.38	11
Chemistry		16.0	16.0	32.1	.29	.18	.25	24
Mathematics ..		15.0	16.5	31.5	.49*	.39	.43*	16
French	No A	14.6	14.0	28.6	.54†	.51†	.55†	23
Economics		13.9	13.5	27.4	.69†	.55†	.65†	28
History		14.5	12.5	27.0	.05	.10	.07	12
English		13.5	12.2	25.8	.21	.16	.26	20

* $P=0.05$ † $P=0.01$ ‡ $P=0.001$

It can be seen that the three science subjects again come at the top of the table although Mathematics, which had come highest in the earlier paper, is now slightly below Physics and Chemistry. French, History and English are in the same relative positions as previously. Economics, however, now has a slightly lower mean total score than French, whereas the converse was previously the case. As is usually found, the arts people do relatively better on the Verbal (V) questions whilst the scientists tend to do better on the Numerical-plus-Diagrammatic (N+D) items.

Since the numbers involved in this paper are rather small, it is to be expected that fewer correlations reach significance level. In the earlier paper, all three science subjects yielded significant correlations. The Mathematics correlations here are slightly higher than before though again, interestingly, only the correlations with Verbal and Total AG scores are significant. Chemistry does less well, but the Physics correlations are roughly of the same magnitude—failing to reach significance because $N=11$ only.

In the previous enquiry, four of the seven arts subjects yielded no significant correlations. Only two of these four subjects, Economics and French, are included in Table 1. It is interesting that they both yield highly significant correlations now with all three indices, V, N+D and total AG scores. On the other hand, English (with V) and History (with N+D and total) were significant earlier but do not now reach the required level.

(ii) *Overall Success at A-Level.*

The sixth form boys were in arts or science divisions according to which A-level subjects they were taking. Economics was a subject common to both groups, being taken by 22 of the arts sixth and by six of the science sixth.

The arts sixth comprised 42 boys of whom 16 took three, and 26 took two, A-levels. It was decided to add the grades of the two best A-level results for each boy, to get an overall assessment of success which would be applicable to all boys in the group. The results are shown in Table 2.

TABLE 2

CORRELATIONS BETWEEN AH6 AG AND SUM OF TWO BEST A-LEVELS FOR THE ARTS SIXTH
N=42

AH6 AG	rho	P
Verbal	.46	.01
N+D	.32	.05
Total	.42	.01

It may be seen that whilst all three correlations are significant, the best agreement is with the Verbal questions.

The results of correlating the sum of the two best A-levels for the 35 pupils in the science sixth are remarkably similar to those obtained with the arts sixth, though the N+D correlation is marginally higher (see Table 3).

TABLE 3

CORRELATIONS BETWEEN AH6 AG AND SUM OF TWO BEST A-LEVELS FOR THE SCIENCE SIXTH
N=35

AH6 AG	rho	P
Verbal	.46	.01
N+D	.38	.05
Total	.42	.01

Five boys in the science sixth took only two A-levels and, of these, three gained poor grades and had low AH6 AG scores. The grades of the three A-levels of the other 30 boys were summed and correlated with AG scores. The correlations were not as high as those given in Table 3 although the order remained the same—Verbal yielding the highest correlation (.36) and N+D the lowest (.21).

In the earlier paper the results of 154 arts and science candidates were grouped together. The summed grades of the 122 boys who took three A-levels were correlated with total AG score, yielding a product-moment correlation of .40 ($P=0.001$). The remaining 32 boys took two A-levels only and had a significantly lower mean AG score than those who took three. It was thought that most boys who were capable would elect to do three A-levels rather than two and, whilst this is to some extent true, with this present sample there are also arts/science differences. The majority of the present arts sixth took two A-levels whereas the majority of the science sixth took three. Since the scientists tend to score more highly than the arts people on AH6 (see Table 1), this arts/science difference in the average number of A-levels taken would be a contributing factor to the significantly higher scores of those who took three A-levels.

Although the method of comparison of success in A-levels is different in the two enquiries, it would seem that the agreement found between overall success in A-levels and AH6 has not diminished. The correlations obtained with a year's interval between the taking of the test and the examinations compare favourably with the correlation obtained in the previous paper.

GCE O-LEVEL EXAMINATIONS

(i) *Specific school subjects.*

Table 4 lists those O-levels which were taken by 10 or more fourth, fifth and lower sixth form boys in 1971, presented in order of mean total score on AH6. These means are somewhat affected by the varying number of boys taking O-levels in different subjects, while in the fourth form. The present sample includes the results of 19 fourth-formers taking French and two fourth-formers taking Latin (the boys having been tested when in the third form). The previous year (1970), the O-levels taken in the fourth form—apart from French—had been somewhat different: 20 boys had taken Latin, 21 English Language and 24 Mathematics. These data, having been incorporated in the earlier paper, are excluded here. The mean scores in Table 4 for Latin, English Language and Mathematics have been lowered by the exclusion of the brighter pupils who took these O-levels in the fourth form.

TABLE 4

COMPARISON OF AH6 AG SCORES WITH O-LEVEL EXAMINATIONS.

	Notes on Examination Grades Awarded	AG Mean Score			Spearman's rho Correlations			N
		V	N+D	Total	V	N+D	Total	
Additional Maths. ¹	No 9	14.7	16.1	30.8	.31*	.03	.22	37
Chemistry		14.2	15.1	29.3	.27	.10	.19	34
Physics	No 8 or 9 ..	14.2	15.1	29.3	.25	.23	.28	34
German	No 7	13.7	13.3	27.0	-.30	-.08	-.23	22
Biology	No 9	12.6	13.7	25.3	.37*	.42†	.47†	34
Latin ²	No 1 or 9 ..	12.5	12.7	25.2	.10	.16	.15	27
French ³		12.3	12.9	25.2	.46†	.31†	.45†	89
English Literature ..		12.3	12.8	25.1	.26†	.27†	.29†	87
History		12.2	12.6	24.9	.31*	.41†	.41†	42
English Language	No 1 or 2 ..	11.8	12.4	24.2	.40†	.35†	.44†	69
Geography	No 1	11.8	12.4	24.1	.42†	.40†	.43†	40
SMP Maths.		11.8	11.5	23.3	.23	.39*	.36	20
Maths.	No 1 or 2 ..	11.4	11.4	22.7	.64†	.51†	.69†	43
General Science	No 1, 2, 3 or 9	9.9	10.6	20.5	.37	-.30	.06	18

* P=0.05 † P=0.01 ‡ P=0.001

¹ 24 boys in fifth form, 13 in lower sixth.² 25 boys in fifth form, 2 in fourth form.³ 70 boys in fifth form, 19 in fourth form.

The 24 boys who took Mathematics while in the fourth form took Additional Mathematics in the fifth form. To these 24 have been added the results of 13 lower sixth boys who took Additional Mathematics for the first time in 1971. (The fifth-formers' mean score was 30.9 and that for the lower sixth, 30.7.) The remaining 63 boys, presumably the less talented in this subject, took either Mathematics or SMP Mathematics in the fifth form and their mean scores come almost at the bottom of Table 4. Similarly, the 34 boys who took Chemistry and Physics as separate subjects have a high mean score whereas those who did General Science come at the bottom of the table. The means for the remaining GCE subjects tend to cluster around that of English Literature, which was taken by *all* the fifth-formers.

Although the mean scores for the school subjects do not fall into a science and arts grouping (as did the A-levels), it is clear that those who do separate science subjects—and who will probably go on to science A-level subjects—score more highly on AH6 than do other fifth-formers.

The grades on GCE O-levels (1 to 9) were correlated with the AH6 scores. Not all grades were awarded in all examinations for these pupils. Over half of the correlations in Table 4 (23 out of 42) are significant at the 0.05 level or better. This is less than was found in the previous paper (where 37 of the 42 were significant). Not only were the numbers larger in the earlier enquiry, but the range of ability was probably greater, being spread over three schools as opposed to one. Most of the significant correlations occur in the middle part of Table 4 where the subgroups taking any particular examination are less selected. It is interesting that N+D predicts relatively better at O-level than at A-level.

In all cases where N is 40 or more, the correlations are significant. Thus, providing the range of ability of those taking the examination is not too restricted, it would seem that AH6 has predictive value, even with a year's interval between the test and the O-level examination.

(ii) *Overall success at O-Level.*

All of the fifth-form boys took at least five O-level examinations. The five best grades gained by each boy were summed to give an overall estimate of his success in O-levels. (As with the earlier paper, for this purpose, the results of examinations taken when these boys were in the fourth form have been included, where appropriate: for 22 boys there was one 1970 examination result, and for 11 boys there were two results which were among their five best grades.) These summed scores have been correlated with AH6 scores (see Table 5).

TABLE 5
CORRELATIONS BETWEEN AH6 AG AND SUM OF FIVE BEST O-LEVEL GRADES
N=87

AH6 AG	rho	P
Verbal	.51	.001
N+D	.50	.001
Total	.58	.001

In the previous paper, product-moment correlations between the summed five best GCE O-levels and AG scores were $r = .50$ for V; $r = .43$ for N+D; and $r = .53$ for total (all significant at the 0.001 level). Thus these present results suggest that the overall predictive value of AH6 for GCE O-level success is well maintained over one year.

ACKNOWLEDGMENTS—The writers are indebted to the MRC for financial support; and to the headmaster who kindly sent us the GCE results.

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(Manuscript received 27th March, 1972)

THE ACADEMIC PROGRESS OF UNIVERSITY STUDENTS FROM
CO-EDUCATIONAL AND SINGLE-SEX SCHOOLS*

BY R. R. DALE AND P. McC. MILLER

(University College of Swansea)

SUMMARY. A comparison of the first-year progress of university students from co-educational schools with those from single-sex schools was made by a matched pair procedure. All students who met the A-level criteria for matching were extracted from those who took the examination of the WJEC in a three-year entry to Welsh University Colleges, with first-year results unknown to the selectors. Variables matched or separated were Arts/Science, sex, population of school area, social class, university institution, and aspects of A-level attainment, namely, number of subjects taken, best subject, average grade and number of attempts. In Arts there was virtual equality, but in Science the co-educated made slightly the better progress, significantly so by comparison of failures.

INTRODUCTION

Research on the progress of first-year university students from co-educational and single-sex schools appears to have been limited to a comparison of academic attainment at the end of the first year at university, without regard to the relative entry attainment level of students from these two types of school. McCracken (1969) analysed the first-year results of students for three successive years (over 5,500 students) and found no consistent pattern of difference between students from the two types of school, though those from single-sex schools had slightly fewer failures in two years out of the three. In view, however, of the doubts about the comparability of the entrance standards of the students from the two types (single-sex schools including, for example, those from the direct grant schools which take highly selected pupils from a wide radius) the findings are of little value for evaluating the comparative progress of students from co-educational and single-sex schools.

In the present study this is assessed, controlling several variables, including attainment on entry to the university, by using matched pairs.

PROCEDURE

The original sample consisted of students from co-educational and single-sex schools who entered four colleges of the University of Wales in 1965-6, 1966-7 and 1967-8, and Swansea 1968-9. It was restricted to those who had taken Welsh Joint Education Committee A-levels and were taking at least one of eight specified subjects at university. These were French, history, geography, applied mathematics, pure mathematics, physics, chemistry and botany. The faculties of Arts and Science were separated and students were divided into four categories or 'levels' according to performance in the Advanced Level examination. The maximum possible number of matched pairs of students from co-educational and single-sex schools was obtained from the larger sample, matching being on population of school area (four categories), sex, social class, university institution, and also on average grades, best subject and number of attempts in the A-level examination. Almost all students sat three subjects but where a selected student sat only two he was paired with a similar student. However, in order to obtain a sufficient number of pairs the exact matching was relaxed after a core sample of 126 pairs had been selected, with the proviso that the difference in one direction for any variable was 'balanced' by one in the opposite direction. Previous examination of the data had satisfied us that there was little difference between the performance of the different social classes in our sample, and accordingly the criteria for matching on social class were relaxed a little further. This resulted in a somewhat smaller proportion of the co-educated than the single-sex educated being from the higher social classes. All matching was done using objective rules with the university grades unknown to the matchers.

There resulted eight opposing samples, one for each category (level) of A-level performance within each faculty. The points allocation for student attainment

* Part of a project assisted by SSRC.

on entry ranged from 1 for grade A to 7 for fail, in each subject, and the comparison was made on average grades. Students sitting twice were given their average grades for the two examinations. The cut-off points for the levels were 1.67, 2.33, 3.0 and worse than 3.0. Two criteria of progress at university were used. The first was attainment at the end of the first year, as measured by calculating the average stanine grade of each student in his three subjects. (In both entry and first year data smaller scores indicate better grades.) The second criterion was the number of subjects failed in first year, the sample being split into students who failed two or more subjects and those who failed one or less.

RESULTS AND DISCUSSION

The stanine grade results (Table 1) show little difference between co-educated and single-sex educated students.

TABLE 1

PROGRESS OF CO-EDUCATED AND SINGLE-SEX EDUCATED STUDENTS: MATCHED PAIRS ANALYSIS (FIRST-YEAR EXAMINATIONS).

Entrance Level	Arts					Science				
	No. of pairs	Mean** difference A-level	Mean first-yr. stanine grades*		Mean difference stanine grades	No. of pairs	Mean difference A-level	Mean first-yr. stanine grades		Mean difference stanine grades
			Coed.	S/sex				Coed.	S/sex	
Level 1 ..	16	Nil	3.67	4.49	+0.82	3	-0.11	1.78	2.22	+0.44
Level 2 ..	37	Nil	4.86	4.55	-0.31	8	-0.04	3.89	4.83	+0.94
Level 3 ..	38	Nil	5.59	5.46	-0.13	15	-0.03	4.67	5.20	+0.53
Level 4 ..	28	Nil	5.38	5.20	-0.18	68	+0.02	5.18	5.32	+0.14
† Extra cases	4	Nil	5.00	5.33	+0.33	4	+0.17	4.08	4.33	+0.25
Total	123	Nil	5.05	5.00	-0.05	98	+0.01	4.85	5.12	+0.28

*.—The larger the stanine the worse the performance.

** A minus difference means advantage to single-sex.

† To increase numbers students near to the Level boundaries were matched across them (maximum difference at entry 0.33); the opposite sides were then balanced according to entrance attainment.

NOTE—t values for the overall differences are 0.31 in Arts and 1.48 in Science.

In the Arts faculty there is virtual equality in performance while in the Science faculty, although the co-educated students do consistently better at all levels, the difference fails to reach the accepted standard of statistical significance ($t=1.48$, $P<0.2$ two-tailed).

On the pass/fail criterion (Table 2) a more definite result emerges.

TABLE 2

PASS/FAIL ANALYSIS BY STUDENTS, CO-EDUCATED AND SINGLE-SEX EDUCATED: MATCHED PAIRS.

Number of students failing in—	Arts		Science	
	Co-ed.	S/sex.	Co-ed.	S/sex.
0 subject	103	98	64	62
1 subject	16	20	23	15
2 subjects	4	4	5	15
3 subjects	0	1	6	6
Total	123	123	98	98

The co-educated students have a very slight superiority in the Arts faculty, and a distinctly larger one in Science. Out of 98 science students from single-sex schools 10 more failed badly (i.e., in two or three subjects) than among those from co-educational schools with which they were so carefully matched. The difference reaches statistical significance on a chi-square test for matched pairs (chi-square = 4.17, $P < 0.05$).

In summary, it would seem that type of school has only a slight association with the standard of university first-year performance. What effect there is tends to occur at the failing end of the first year university performance and is in favour of the co-educated students, suggesting, if replicated, that more of the single-sex educated may find the transition to university difficult and therefore be at risk. We are at present unable to suggest why this effect appears to be more marked in Science than in Arts. Possible explanations based on student social class, provision of school science facilities and standard of teaching at school have been investigated and do not appear to be valid.

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(Manuscript received 4th March, 1972)

STRUCTURE D'ENSEMBLE, MULTIPLE CLASSIFICATION, MULTIPLE SERIATION AND AMOUNT OF IRRELEVANT INFORMATION

BY B. REMMO HAMEL AND M. A. A. VAN DER VEER

(Free University, Amsterdam)*

SUMMARY. A significant positive correlation between multiple classification performance and multiple seriation was found, in testing 65 children aged 6 to 8 years, at the stage of concrete operations. This is interpreted as support for the existence of a structure d'ensemble of operational schemes in the period of concrete operations. It was also found that the amount of information given strongly affects the problem-solving behaviour of children.

The subject of the research described in this article is the 'structure d'ensemble,' a concept introduced by Piaget. In his discussions of the development of intelligence Piaget uses the notion of stages, and he lists a number of criteria that this stage concept must meet (1956). There must be a constant order of succession. Further, each stage must be of an integrating character, that is, the structure established at a particular level becomes an integrated part of the following level. At the same time this implies that Piaget's term, stage, points to an organised totality, a structure d'ensemble, in which various actions or operations are interconnected by ties of implication. Moreover, both the preparations for a stage and the achievements that characterise a stage are to be ascribed to the existence of a general structure. Such a general structure encompasses all the operational schemes of a particular stage (Piaget, 1960). This implies that problem-solving behaviour in the stage of concrete operations may be reduced to a structure d'ensemble, namely the collection of eight groupings with which Piaget (1947) describes this stage.

The idea of a structure d'ensemble leads to hypotheses concerning the relationships among the development of various task-solving abilities. Thus a child mastering a task which requires a specific operation should be able to master any task involving those operations that form a structure d'ensemble with this operation. For example, one would expect that a subject who successfully completes a multiple classification task, would also be able to solve successfully problems which involve multiple seriation operations.

* Paedologisch Instituut, Vrije Universiteit te Amsterdam, Vossiusstraat 56, Amsterdam.

In Piaget and Inhelder (1959), Lovell, *et al.* (1962), Smedslund (1964) and Shantz (1967), empirical support is advanced for this supposition. However, there are other experimental results which do *not* support Piaget's prediction. These experiments pertain to tasks other than multiple classification and multiple seriation. Thus Piaget himself found asynchronism in the acquisition of the formally identical tasks of provoked and unprovoked correspondence (Piaget and Szeminska, 1941). Piaget and Inhelder (1962) report that conservation of weight generally develops two years later than conservation of mass despite the fact that these tasks, albeit in different domains, require the same logical operations. Elkind (1961a) states that conservation of quantity is mastered earlier with discontinuous than with continuous material and also that conservation of weight is more difficult to acquire than conservation of amount but easier than conservation of volume (Elkind, 1961b). Thus Piaget (1956) emphasises that the simultaneous development of the operations in a structure d'ensemble is observable only when they are tested within the same domain—for example, if all tasks are related to amounts of discontinuous material.

Pinard and Laurendeau (1969) suggest that for the time being the structure d'ensemble criterion should be investigated only to see whether the different groupings are achieved in synchrony on tasks related to the same conceptual content and, if possible, the same material.

Flavell and Wohlwill (1969) propose delimiting the structure d'ensemble in another way, namely, to a structure of operations which belong to a single grouping. They also point out that stimulus variables such as the amount of irrelevant information in the task determine in part the performance on that particular task.

The first purpose of our experiment was to determine whether, when certain stimulus variables are controlled, it is possible to show that there is a structure d'ensemble of various operational schemes in the period of concrete operations. We followed the recommendation of Pinard and Laurendeau (1969) by using tasks as similar as possible. The second aim of our experiment was to investigate how certain stimulus variables affect achievement on these tasks. To that end the performances of children on multiple classification tasks and multiple seriation tasks were compared. At the same time the amount of irrelevant information was systematically varied with each task.

In accordance with Piaget's views we state the following hypotheses :

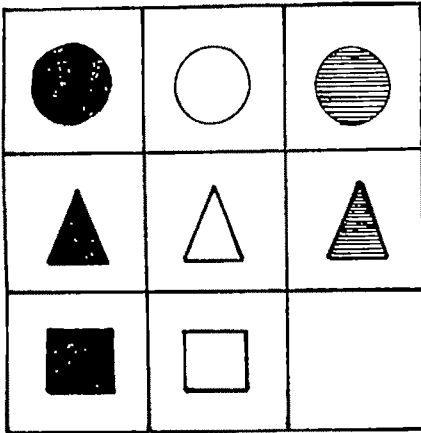
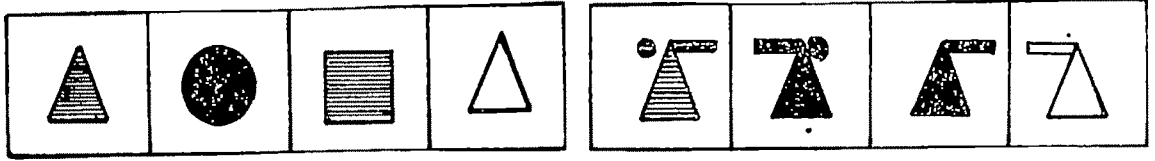
- (1) There is a significant positive relation between the achievement of the subjects on multiple classification tasks and multiple seriation tasks.
- (2) As the amount of irrelevant information in the stimulus situation increases, the achievement on multiple classification tasks as well as on multiple seriation tasks decreases.

METHOD

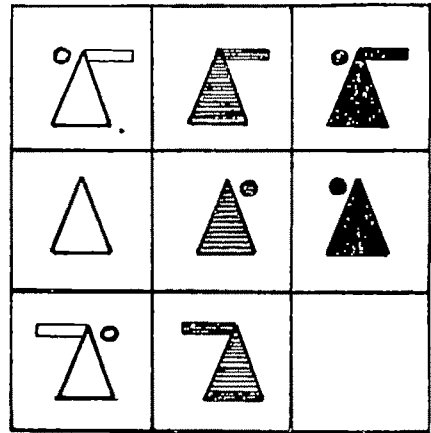
Subjects. Sixty-seven children from a middle-class junior school participated in the experiment. Group I consisted of 32 pupils from the 1st grade (mean age 78.0 months, SD 8.1 ; mean IQ 96.3, SD 14.2). Group II consisted of 35 pupils from the 2nd grade (mean age 87.6 months, SD 6.8 ; mean IQ 102.3, SD 13.0). Both groups included boys and girls ; no sex differences were found in the results.

Material. IQ was measured by the Amsterdamse Kinder Intelligentie Test (Drenth, Petrie and Bleichrodt, 1968). The multiple classification task contained 30 items. Each item consisted of a 3×3 matrix with 8 simple geometric figures. The figures were ordered according to 3 values of 2 classification dimensions (e.g., colour and form of the figures). In this matrix one figure is missing. The subjects chose the missing figure out of four pictured above the matrix. In items 11–20 one irrelevant classification dimension was added to the task. In items 21–30 two irrelevant classification dimensions were added (see Figure 1). The multiple seriation task consists of 30 items. Each item is composed of a 3×3 matrix with 8 simple geometric figures. The figures were ordered according to 3 values of 2 seriation dimensions (e.g., height and width). As in the multiple classification task one irrelevant seriation dimension was added to items 11–20 and two irrelevant seriation dimensions to items 21–30 (see Figure 2).

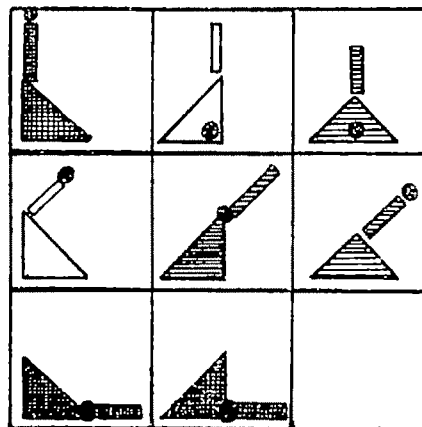
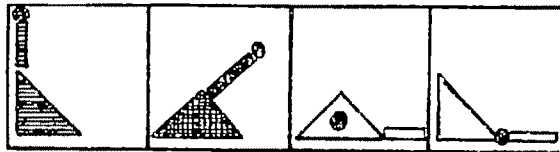
FIGURE 1
MULTIPLE CLASSIFICATION TASKS.



Plus 0 irrelevant dimension.

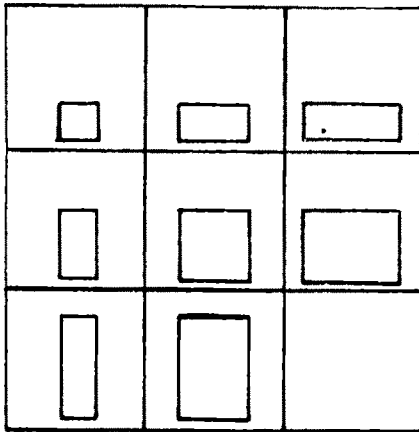
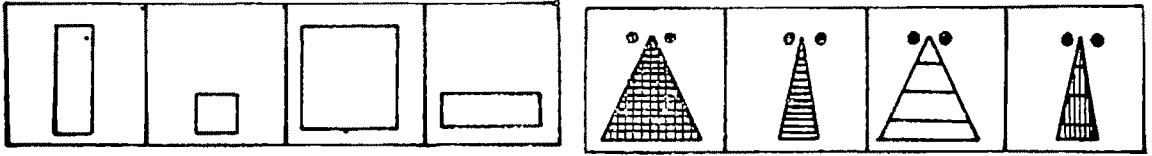


Plus 1 irrelevant dimension.

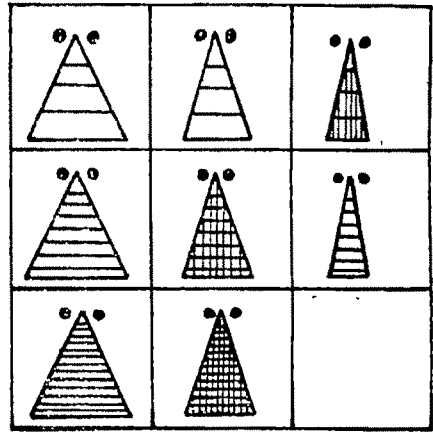


Plus 2 irrelevant dimensions.

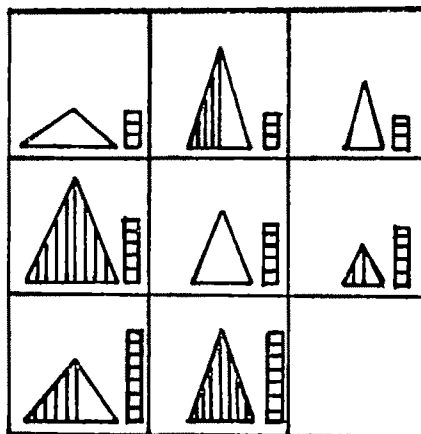
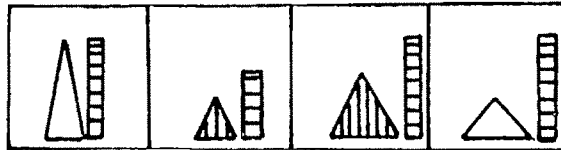
FIGURE 2
MULTIPLE SERIATION TASKS.



Plus 0 irrelevant dimension.



Plus 1 irrelevant dimension.



Plus 2 irrelevant dimensions.

Procedure. First we checked in a pretest whether the subjects could distinguish the classification and seriation dimensions used. After this the multiple classification task and then the multiple seriation task were presented. In each item of these tasks the subject was asked to choose from the four figures above the matrix the one which was missing in the 3×3 matrix. In items 11-30 the relevant dimensions were verbalised by the experimenter (e.g., "Note the colour and the form.")

RESULTS

From the pretest it appeared that all the subjects could distinguish the different values of the classification and seriation dimensions used and were able to name them in some way. In an item-analysis a homogeneity (KR_{10}) of .73 with a standard error of measurement of 2.39 was found for the multiple classification task and a homogeneity (KR_{20}) of .67 with a standard error of measurement of 2.37 for the multiple seriation task.

TABLE 1

CORRELATIONS OF MULTIPLE CLASSIFICATION SCORES, MULTIPLE SERIATION SCORES AND IQ.

	r_{12}	r_{13}	r_{23}	$r_{12.3}$
Group I	.72	.64	.50	.60
Group II	.66	.39	.54	.59

1. Multiple classification scores. 2. Multiple seriation scores. 3. IQ.
All correlations are significant, $P < .01$.

TABLE 2

MEAN SCORES ON MULTIPLE CLASSIFICATION AND MULTIPLE SERIATION.

	Items		
	1-10	11-20*	21-30†
Group I: Multiple classification	4.75	3.75	2.97
Multiple seriation	5.91	3.69	2.44
Group II: Multiple classification	6.29	5.20	3.71
Multiple seriation	6.86	4.26	2.86

* One irrelevant dimension.

† Two irrelevant dimensions.

Table 1 shows that there is a significant positive relationship between the achievements on multiple classification and multiple seriation tasks in both groups of subjects (r_{12} and $r_{12.3}$). These results support our first hypothesis. Table 2 shows that the mean score per task decreases as the number of irrelevant dimensions increases. The differences between the means are significant: Friedman two-way analysis of variance (Siegel, 1956) gave the following results:

Group I, multiple classification, X^2_{15} , df2, $P < .001$.
multiple seriation, X^2_{33} , df2, $P < .001$

Group II, multiple classification, X^2_{33} , df2, $P < .001$
multiple seriation, X^2_{51} , df2, $P < .001$.

These results support the second hypothesis.

DISCUSSION

The significant positive values found between multiple classification and multiple seriation can be interpreted as support for the existence of a structure d'ensemble of operational schemes in the stage of concrete operations. However, one may ask how low the correlation value would have to be in order to consider the hypothesis related with the structure d'ensemble falsified. This is especially necessary because this structure d'ensemble is still developing in this period.

Here our concern is limited to a very narrowly defined structure d'ensemble: a coherent system of multiple classification and multiple seriation operations in as far as these are applied to tasks which are similar in as many aspects as possible. As the tasks we used were highly similar—both tasks consisting of 3×3 matrices with simple geometrical figures and with almost identical instructions—this could lead to the interpretation that the high correlation found between the scores is to be attributed to a single intelligence factor, namely, 'matrix-solving ability.' Further, one could suppose that the performance on both tasks is dependent on 'general intelligence.' Yet even when the influence of general intelligence is partialled out, there is still a positive correlation between multiple classification and multiple seriation (see Table 1). Nevertheless, it remains uncertain whether the subjects may solve these problems by other ways than by using operational schemes.

From our results it appears that the amount of information strongly affects the problem-solving behaviour of children in the stage of concrete operations. Therefore, it seems sensible to follow Flavell and Wohlwill's (1969) suggestion to employ the distinction between competence and performance in the description of cognitive development.

However, to determine the validity of this distinction a longitudinal study of the transitional period between the preoperational stage and the stage of concrete operations is required. The results of such study, in which the data of each *individual* are analysed (and *not* group data), could then establish how far the different logical operations develop in synchrony and how far performance is affected by irrelevant stimulus variables. This would seem a desirable amplification of our investigation which was a cross-sectional study of the concept of structure d'ensemble.

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(Manuscript received 16th March, 1972)

BOOK REVIEWS

BERNSTEIN, B. (1971). *Class, Codes and Control. Volume I: Theoretical Studies towards a Sociology of Language*. London: Routledge and Kegan Paul, pp. 238, £3.00.

This volume comprises a selection of 11 of Bernstein's papers spanning a period of about 12 years. Grouped under the headings of 'Beginnings,' 'Developments' and 'Explorations' these papers show the origin and development of the author's theoretical studies of the relationships between social structures, patterns of speech and the socialisation of the child. The course of this development is described by the author in an interesting and helpful introduction in which he pays tribute to those who have influenced his thinking. Some of the papers carry a short, specially written introduction which helps to provide continuity with preceding articles. The key concept of Bernstein's theory is that of 'code,' an inferred regulative principle which, in the case of 'socio-linguistic codes' underlies the use of language and, in that of 'educational knowledge codes,' governs aspects of curricula, pedagogy and evaluation. Most of the papers in this volume deal with the former type of code, the latter type being a very recent theoretical development.

According to Bernstein, different forms of social relationships can generate quite different speech systems by influencing the verbal planning procedures of both speaker and listener. To these planning procedures, termed codes, Bernstein attributes the power to shape not only the pattern of a child's speech but also his cognitive, social and emotional orientation to his environment. Two major and fundamentally different types of code are postulated, termed 'restricted' and 'elaborated.' The major function of the restricted code is to restrict the verbal communication and elaboration of the individual's unique experience, for the social roles giving rise to this code are individualised rather than communal. The main linguistic features of this code are that it draws from an extensive range of syntactical forms, and vocabulary and meanings are verbally explicit and 'context free.' In general, 'middle class' children can be expected to command both types of code, whilst some 'lower working class' children may be limited to the restricted code, although, within the broad social class divisions, the type of code that is prevalent in a given family will depend upon its type of 'family role system,' i.e., whether it is a 'positional' family or a 'person centred' family.

A possible criticism of the linguistic code theory is that it presents a dichotomy between two qualitatively different forms of speech; children either have the elaborate code or they do not. It seems more likely, however, that these two speech codes may represent the extremes of a continuum. Perhaps in order to meet this objection and also to give greater importance to the context in which the speech is produced, Bernstein, in a more recent paper, distinguishes between linguistic codes and 'speech variants,' such variants being defined as patterns of linguistic choices which are specific to a particular context. This modification of the theory allows Bernstein to account for cases where restricted code speakers may use elaborated speech forms in certain situations but, inevitably, it complicates the process of identifying the person's underlying code.

The most important educational issue raised by this theory concerns the teaching of the child who is confined to the restricted code. Bernstein strongly attacks the notion that such children are linguistically deprived and therefore in need of 'compensation.' Such children, he states, do have access to more elaborated speech forms (variants) although they are predisposed to use restricted forms in most of their communication situations. The problem, therefore, is how to encourage

these children to use elaborated speech forms in a wider range of contexts, particularly those met in school. However, according to Bernstein, the solution is not simply a linguistic one, for a change in the habitual speech mode involves change in the underlying pattern of social roles, relationships and systems of meaning.

This view is certainly a strong challenge to that which regards such children as 'linguistic deficit systems.' Unfortunately, however, none of the papers in this volume contains suggestions as to how the teacher might set about the formidable task of inducing a change in the restricted code speakers' orientation toward language use. In his introduction, Bernstein states that this omission is quite deliberate and stems from the fact that, when the papers were written, he did not consider that sufficient was known about the problem to make any positive recommendations to teachers. It is to be hoped that the continued development of the theory and the empirical research stemming from it will lead to much clearer educational implications and positive suggestions for educational practice.

These papers require concentrated effort to follow because much of the writing is at a high level of abstraction and abounds in socio-linguistic technical terms. Moreover, there is insufficient illustration of points or arguments by concrete examples. Such features may limit the readership of the volume but, nevertheless, as a convenient source book of Bernstein's theoretical studies it will be useful to all those interested in the sociology of language and to educationists.

T. Cox.

DANZIGER, K. (1971). *Socialisation*. London: Penguin Books, pp. 175, 45p.
 SCHAFFER, H. R. (1971). *The Growth of Sociability*. London: Penguin Books, pp. 199, 50p.

Although there is a certain amount of overlap in the subject matter of these two books, they differ considerably in terms of scope, to the extent that the area dealt with in Schaffer's book is compressed into one chapter (of twelve) in Danziger's. This comparison highlights the problems which the latter has had to face in trying to encompass the whole field of socialisation in one slim volume. By including his evaluation of various approaches to the study of socialisation, some extremely pertinent and methodological criticisms of key studies, and an expression of his own (admittedly rather speculative) framework for conceptualising research results, he adds considerably to these problems, but does at least prevent the book from becoming (as it might easily have done) an exhausting and unenlightening "Cook's tour" of research findings.

Not surprisingly, the resulting product has its shortcomings, particularly if viewed as an introductory text. It is really an assemblage of papers (with one or two unifying themes) whose arrangement follows no very obvious organisational principle. (Why, in particular, is the clearly fundamental topic of social attachment deferred until Chapter 8?) More importantly, pressures are such that generalisations often have to be made without reference to specific research, and, since the author's own interesting, plausible, but unsubstantiated opinions are sometimes stated in a rather dogmatic way, it might be difficult for the untutored reader to disentangle the two. However, a student who has acquired some degree of psychological sophistication, and who has done some independent reading should find the interpretative and methodological points very stimulating.

Although (or perhaps because) it deals with a more limited area in greater detail, Schaffer's book manages to convey a clearer sense of how (to borrow Roger Brown's phrase) the game is played. His account of primary socialisation is organised around three questions. On what basis is the infant initially attracted to other human beings? How does he learn to distinguish one from another? And how does he come to form emotional bonds with certain specific individuals? The answers to all three are given in almost exclusively cognitive terms. Human beings are initially attractive as the most interesting collection of stimuli encountered

regularly. Familiarisation is a particular example of the general phenomena of perceptual learning and perceptual constancy. Attachment becomes possible when the infant develops the conceptual ability to respond to the mother in her absence. (There seems to be a bit of cheating on this last point, because attachment is *defined* in terms of separation upset—which clearly requires this ability.) Although an account of the cognitive *aspects* of early socialisation is clearly welcome, a purely cognitive *theory* of early socialisation seems a bit extravagant, particularly since it is admitted that the consequences of maternal contacts depend so much on their correspondence with the infant's needs at the time. However, the evidence is presented fairly, the documentation is meticulous, and the reader is put in a position to judge for himself.

Both of these books put a wholly commendable emphasis on the part which the child plays in the socialisation process, not only as one whose organismic and developmental state modulates the effects of any parental treatment, but also as one whose behaviour is an important determinant of parental treatment. And both include, in common with others in this series, extremely useful lists of references.

W. B. HANTON.

GAMMAGE, P. (1971). *Teacher and Pupil*. London: Routledge and Kegan Paul, pp. 116, c. £1.20, p. 60p.

This book is described as "the first British students' guide to the social psychology of learning" and is said to be structured round the major theme of interaction. As the text is limited to 99 small pages—determined presumably by the character of the series, the Students' Library of Education—the task the author has undertaken is therefore indeed a formidable, if not impossible one.

He begins with a discussion of the elements of group dynamics, goes on to look at sociometry as a tool for exploring the structure of classroom groups, gives three chapters to a consideration of the teacher in the classroom—his image, his interaction or teaching style, and his place in society—and thence to a consideration of pupil factors—personality, social orientation and linguistic environment, and the classroom implications of various aspects of psychological development.

In the treatment of this material, the consequences of the textual constraint are both obvious and serious. Reference to only a very limited selection of the appropriate literature is possible, discussion of the interaction process is given much less attention than is necessary, terms are introduced without being adequately defined and the basic chapter on group dynamics is far too compressed to permit an adequate structural framework for the remainder of the book to be presented. In the section on sociometry, too, when students might have been encouraged to interact with significant members of school classes, there is insufficient detail to allow them to design a questionnaire without reference to another text.

Interspersed with the reference to the literature are comments derived from the author's own experience and prescriptive pieces of advice are offered to intending students. Treatment of the subject-matter in this manner is consistent with the editorial comment that "the issues discussed are ultimately educational in nature and therefore go beyond the confines of any supposed value-free science." The values that are implicit in such treatment, however, may not be those which many readers would expect to govern the selection of material for a student's guide to the social psychology of learning. One suspects, too, that one of the criteria which influenced the selection of material was the degree to which it was consistent with the prescriptive statements. For example, favourable comment is made about the creation of a democratic classroom climate, but no reference to the work of Fiedler is made. Material of this kind would have helped greatly to make explicit the complexity of the processes which are being discussed.

For these various reasons it would seem ill-advised to recommend this text as an introductory one for students without the tutor being prepared to contribute very substantially to the seminar discussions.

D. S. FINLAYSON.

GORDON, E. (1971). *The Psychology of Music Teaching*. London: Prentice-Hall, Inc., pp. 138, £2.00.

Recent years have seen something of a revival in the interest shown in the nature of musical ability, and the problems associated with its development in children of all levels of musical ability. This is reflected in the publication of Bentley's Tests and the splendid book by Rosalind Shuter. For those concerned with musical education a sense of urgency has been imparted to this situation by (a) the finding of the Newsom Committee that music is the worst equipped and accommodated subject in the curriculum, and (b) the discovery in the Schools Council Enquiry No. 1 that 15-year-old leavers of both sexes found music not only the least useful subject in the curriculum but also the least interesting.

In this climate of opinion the Schools Council have started a number of projects, and it would have been thought that, in such a situation, books which suggest new approaches to teachers and which stimulate new thinking would be welcome.

Gordon's book is one of a series of books on Contemporary Perspectives in Music Education, published in the USA under the editorship of Charles Leonard. The range of titles is impressive. It is possible that the publication of this series reflects a similar crisis among music educators in the USA.

The book is in two parts, the first part concerned with the source, description and evaluation of musical aptitude, and the second with musical achievement and procedures which are recommended as likely to stimulate and encourage this.

In the first short chapter on the source of musical aptitude, the author puts forward the view that the nature-nurture issue has probably had more direct influence on music education than any other single concept. He does not support this contention, but simply considers its implications. Having looked at some of the evidence, he concludes that "because of the limited quantity of research, the source of musical aptitude cannot be completely explained."

He appears somewhat surprised to find that many students are not achieving in accordance with their musical potential, and that some 20 per cent of students, who would, in our terminology, be described as music students, fall in the lowest third of the population at large. While from the point of view of the music educator this is undesirable, surely it is to be expected, particularly with the limited time available in the school timetable. Many students with considerable musical aptitude will decide that their interest and future are best served by specialising in another subject and keeping music as a hobby; others, who are less gifted musically or intellectually will opt for music, because they happen to be interested in it. He concludes with the following exhortation: "Hopefully the implications of such fearful findings will not only support the desire to improve teaching procedures but also cause music educators to question whether they are meeting their responsibility to all students."

His second chapter considers both subjective and empirical definitions of musical aptitude. His discussion of empirical definitions is made up of a brief description of the best known tests of musical aptitude. Most space is devoted to his own Musical Aptitude Profile, and it is used quite extensively to examine the relationship between musical aptitude and factors like environmental background, psychological characteristics and race, religion and nationality. His discussion of the evaluation of musical aptitude is confined to pointing out the uses of tests of musical aptitude and the qualities to be looked for in such tests.

The second part of the book discusses musical achievement. He takes as his starting point the approach of Gagné as described in his book *Conditions of Learning*. Gordon very briefly illustrates this approach using musical examples for each of the eight types of learning. In the space of the same two pages he refers also to the work of both Piaget and Bruner. From this very brief synopsis of their views he derives some teaching principles which give a very strong emphasis to cognitive factors, and then, in a final section, goes on to discuss the objectives of musical education. Gagné, Piaget and Bruner may well have useful things to say to the music teacher, and indeed some writers have already attempted to demonstrate this, but one is disappointed by Gordon's scant treatment of them. If they are worth mentioning at all, then some attempt should have been made to develop these views more fully. As it stands the chapter is singularly unconvincing; it almost looks like an attempt to give music teaching respectability by emphasising its cognitive aspects. Little use or reference is made of these principles in the later chapters of the book.

Having taken the view in the first part of the book that musical aptitude comprises tonal imagery, rhythmic imagery and musical sensitivity, he then goes on to discuss how these qualities might be developed. He uses the analogy of reading and writing one's native language; like many arguments by analogy, this has its limitations. There is an unwarranted inevitableness about his statement: "Likewise, as a person progresses in music from simple rote singing and sensuous listening to the development of music literacy, he will systematically learn to understand music because he will more efficiently conceptualise complex aspects of musical sound and be able to study, create and perform independently."

In his treatment of rhythmic learning he advocates a highly structured approach paying brief attention to any relevant research. Rhythmic readiness and individual differences in ability to read and write rhythmic patterns are discussed, but what a teacher with a class of 30-plus children and, at best, two periods a week can do about this is not considered. Like the succeeding chapter on tonal learning, this chapter concludes with a section on theory of rhythmic notation. In both these chapters the word 'theory' is being used in a very loose sense indeed.

The last chapters deal briefly with listening, instrumental music and the evaluation of musical achievement.

Presumably the group that Gordon has in mind when writing this book consists of students in colleges in the USA, who, before taking such a course, would have taken several background courses in psychology. In the United Kingdom there are very few students of this kind to be found either in PGCE courses or in colleges of education. In any case the style is unattractive, and made particularly so by the many fleeting references to research; the result is a book which is not calculated to generate interest in the subject. The bibliographies given at the end of each chapter could, however, be useful to students doing special studies in this area.

Many of the criticisms that can be levelled against this book result from Gordon's attempts to cover too much ground in a book of only 138 pages; it falls therefore between two stools—neither dealing adequately with research literature, nor developing sufficiently the implications of these findings and theories for teachers.

R. G. HANNA.

JOHNSON, P. E. (1971). *Psychology of School Learning*. Chichester: J. Wiley, pp. 124, £2.50.

This has been a difficult review to write. The opening sentence reads: "This book is written for the individual who attempts more or less systematically to change the behaviour of others." The expectation that this implies a theoretical position and a view of education both of which this reviewer considers inadequate was fully confirmed; which imposes on the reviewer an obligation to be particularly fair to a representative of a viewpoint different from his own. This in turn requires that the

arguments of the writer be adequately summarised before being attacked. But to do so would require a review of the length of Chomsky's famous review of Skinner's *Verbal Behaviour*, which is far beyond the available space. This reviewer is not a Chomsky; nor is the author a Skinner—indeed, the latter point of view can seldom have been less convincingly put forward.

Only two types of learning are described: 'type 1,' which is Pavlovian conditioning, and 'type 2,' which is also called Skinnerian, instrumental, or operant conditioning. The terms 'reinforcer,' 'reinforcement' are used confusingly: e.g. (p. 39) "we might choose to reinforce the rat only when a tone appears." But in S-R theory, surely it is a habit which is reinforced? Elsewhere (p. 45) food is called both a reinforcer and a reinforcement, which is to equate cause with effect. "To apply principles of operant conditioning to human behaviour we determine reinforcers" (correct usage) "by finding out for what he will work . . . 'Which would you rather have, a peanut, chocolate, or a paper clip?'" But no data are given from experiments with human subjects; and possibly the most important reinforcer assumed in Skinner-type programmed learning, knowledge of the correctness or otherwise of a response, is not mentioned. Though the use of a secondary reinforcer is illustrated by an example of how a dog can be trained to put his nose to a doorknob, no suggestion is offered as to what sort of reinforcers are effective in school situations, or what kinds of behaviour can be taught thereby. So some of the best published evidence in support of the Skinnerian position so far as school teachers are concerned is omitted: namely that simple behaviours such as remaining in his seat, keeping quiet, paying attention to the teacher, can be taught by the principles of operant conditioning.

The chief merits of this book are a clear and jargon-free style, which makes it relatively easy to spot the many weaknesses and omissions; at intervals, a disarming awareness on the part of the author of the gaps between what he is saying, and what is needed to be useful for school learning and teaching; and a good booklist at the end of each chapter, which includes names such as Piaget, Bruner, J. McV. Hunt. But none of the kind of thinking exemplified by these has penetrated the text.

RICHARD R. SKEMP.

KING, R., RAYNES, N. V., and TIZARD, J. (1971). *Patterns of Residential Care. Sociological Studies in Institutions for Handicapped Children.* London: Routledge and Kegan Paul. pp. 255, £3.50.

This book reports studies of the way in which children in institutions (hospitals, hostels and voluntary homes) for the mentally handicapped are dealt with by the staff. Homes for deprived children and a paediatric long-stay hospital for children were included as control groups. The authors are already well known for their work and publications on this topic.

The first four chapters give the necessary background to the studies, and the numbers of mentally handicapped children, and the provision made for their care. Chapter 3 discusses some of the factors which may be important in the cognitive and emotional development of children in their own homes and in institutions. A survey of the nature-nurture problem, though brief, is comprehensive, and the authors make two important points. The first is how little attention generally psychologists pay to the detail of the lives children lead, especially those that we now call 'culturally deprived'; the second is that psychologists tend to "use the word 'environment' as though it were a trait like height which varied along a single continuum . . . from good to bad . . ." (p. 26).

The investigations reported in the succeeding chapters were done in two stages. Stage one consisted of 'Field Studies,' the aim of which was to establish, on the basis of earlier work by Wing and Brown (1970) and Goffman (1961), dimensions along which the management of the children could usefully be measured.

Questionnaires, interview and observation schedules and a Child Management Scale were developed in the field studies.

The Child Management Scale measured four characteristics: rigidity of routine; 'block treatment'; depersonalisation; and social distance. In the field studies, hospital wards showed high scores on these scales; homes for deprived children the lowest scores, and hostels for severely subnormal children also showed scores significantly lower than the hospital wards, but not so low as the homes.

In general it could be said that the homes and hostels were child-oriented in their child management practices and the hospitals institution-oriented.

The developed scale, questionnaires and observation schedules were then used in the second stage, the survey proper in eight local authority hostels, five hospitals and three voluntary homes, all for severely subnormal children. Thirteen hypotheses were set up, and tested by analysis of the scores obtained by the institutions.

Again it was found that the hospitals were institution-oriented in their child management practices, the local authority hostels more child-oriented, and the voluntary homes overlapped with both groups.

It appeared that the difference in orientation was not related to the degree of handicap of the children, nor to the size of the living unit (ward or hostel), nor to the staff-child ratios. It was related to the amount and kind of supervision exercised from above over the head of the living unit, and to the extent to which she had quasi-household responsibilities (e.g., catering, buying food and clothes, etc., for the children). It was also related to the kind of training the head of the living unit had received—i.e., training as a nurse or in child care.

Some incidental observations are presented about what the children could do, the amount of speech they had, and whether they were able to feed themselves; it appeared that though the children were all classified as severely subnormal, more of the children in the child-oriented institutions had some speech and could feed themselves than in the institution-oriented hospital wards. The authors draw no conclusions from these incidental observations, but state firmly their belief that the children must be treated as individuals and with respect. They apologise towards the end of the book for the emotionally toned names of the sections of the Child Management Scale, an apology which is quite unnecessary. By coincidence, the reviewer has had recent experience of visiting geriatric wards and remembers too well her own seething rages at the depersonalisation, etc., of the old people which was evident there. This experience makes clear to her the effort which has gone into producing such cool objective statements of the child management practices observed and measured in the institutions surveyed.

The scales, and other instruments used in the studies are given in full in the appendices so that they may be used by other researchers prepared to start where the investigators have left off. They could be modified for use in other hospitals and homes for, say, old people, and perhaps in schools too. In spite of its rather specialised title, the book contains ideas and comments which are important for all psychologists interested in the development of children. The fact that it shows psychologists and sociologists working productively together adds to its merits.

AGNES CRAWFORD.

McFARLAND, H. S. N. (1971). *Psychological Theory and Educational Practice*. London: Routledge and Kegan Paul, pp. xii+323, c. £2.25, p. £1.00.

In the final chapter Professor McFarland sets out a concise summary of the aims of his book. "Teachers certainly do make free assumptions about... (the)... concepts that have been analysed in the earlier chapters of this book. But some of these assumptions are just not good enough. They do not correspond to a sophisticated professional ideal which would expect the individual teacher to get to the bottom of relevant psychological problems..."

The analysis starts with a somewhat iconoclastic overview of empiricism and explanation in psychology and a statement of the relevant educational context. This is followed by a useful, if brief, summary of developmental patterns from infancy to adolescence. Certain basic concepts such as learning, intelligence, remembering, motivation and attitudes are then reviewed in more detail and a concluding section concentrates upon applied educational psychology.

Throughout, the author's aim is to assess and question and to encourage the reader to do the same. At this reflective level the book succeeds admirably, presenting psychological research at a sufficient distance for critical focus. Not only teachers will benefit from working through and attempting to counter the logical and often humorous probing the author provides. It is unfortunate, however, that the psychological theories considered do not constitute a sophisticated professional analysis. The danger associated with a commentary from an impartial distance, of missing significant internal changes in the discipline, has not entirely been avoided. It is no longer sufficient to refer to cognitive psychology and neglect the lessons to be learned from a decade of psycholinguistic research—particularly when such issues as meaning and structure are central to the main educational argument. These ideas are not summarised by information theory nor by generalities based on servo mechanisms. Psychological theory is changing faster and more radically than the author allows and teachers especially ought to know about it. This is a notable imbalance in an otherwise valuable book relevant to students of psychology as well as education. Few errors were noticed; 26 chromosome pairs is clearly wrong and there is some confusion between accommodation and adaptation in Chapter 3.

A. L. WILKES.

MORRIS, P. R., and WHITING, M. T. A. (1971). *Motor Impairment and Compensatory Education*. London: G. Bell and Sons, Ltd., pp. 256, £2.50.

In a review for another journal of Mittler's monumental work on the *Psychological Assessment of Mental and Physical Handicaps*, this reviewer, while on the whole congratulatory, found occasion to suggest that a chapter on motor handicap might well have complemented the others. Morris and Whiting would clearly have been excellently equipped to fulfil this task but it is perhaps to our advantage that they have instead been able to carry it out more comprehensively in this book.

In his earlier writings, the late Sir Cyril Burt showed even then his insight into the importance of motor skills for adequate cognitive development when he remarked in *The Backward Child* that "it is a truism in psychology that the mechanism of the mind stands on a sensori-motor basis. The world outside can stimulate the mind only through one of the senses; and, in return, all that the greatest intellect can do is to contract a set of muscles and move a set of bony levers. The end product of every mental process is simply a muscular reaction." He was then clearly reflecting on the work of Itard, Seguin and Madam Montessori, work which has in turn been in fashion, out of it, and now, following the renewed interest of Kephart, Ball and others, is the fountainhead of a significant output of books and papers of special significance to all educators and psychologists with any pretensions to working effectively in the field of physical or mental handicap, remedial education, or assessment.

Morris and Whiting have produced 'a source text for students' in these fields which lives up to this description even if there is some unevenness in the balance and quality of the chapters. In the first place, the title itself could be misleading about the emphasis of the volume. The book consists of six chapters; a simple, sensible introduction, a chapter on the aetiology of motor impairment, others on motor impairment and intellectual development, motor impairment and the socialising process, body concept, and assessing motor impairment and then only one chapter of some 40 pages on compensatory education. The second chapter on aetiology is

perhaps somewhat cursory for readers with a medical or neurological background but gives a general overview of causative factors in a fashion to suit undergraduate students of other disciplines—even if it is marred, as at other points in the book, by spelling errors and other evidences of poor proof reading, e.g., 'cereballar' (p. 54), 'that' for 'than' (footnote, p. 60). Another irritant to this reviewer, which always looks like padding, is the authors' decision to supply references (many re-duplicated) at the end of each chapter. The bulk of these are relevant, recent and readable so it is a pity that they are not collected together as a single bibliography of real worth to student and researcher alike. Placed as they are, they are not always easy to refer to.

These, however, are relatively trivial criticisms of a book which deals with its subject comprehensively, clearly and, for the most part, critically. This reviewer happens to be favourably biased toward its subject and the treatment of it because of personal involvement in sensori-motor training and the concept of body image, in mental defectives of all ages, many with substantial motor handicaps. His copy is liberally sprinkled with underlinings and approving ticks and, in the event, the short treatment of compensatory education still allows the teacher to devise specific exercises, cognitive and neuro-muscular, in the classroom from the general principles of the Kephart/Frostig and Horne/Tansley approaches so clearly summarised in this chapter.

The authors address the book to students of education, physical or otherwise. They are unduly modest in feeling that it may interest others. It is certainly a most useful addition to the reading list of all developmental, clinical and educational psychologists; to researchers in motor skills it contains useful, if brief, summaries of recent work and to occupation centre staffs, occupational therapists and physiotherapists, and even to paediatricians, it may easily and quickly become a set book. It very adequately fills a notable gap in the literature on handicap.

D. F. CLARK.

PEEL, E. A. (1971). *The Nature of Adolescent Judgment*. London: Staples Press, pp. 184, £2.25.

This admirable book should be of great interest not only to teachers and psychologists dealing with adolescents but to anyone who seeks to understand and train judgment-making at any age. It is written with all Professor Peel's characteristic lucidity and directness, and is particularly welcome for its originality in exploring a little studied area of educational psychology.

Professor Peel starts with the assertion that above all else the adolescent and young adult apprehend inconsistencies between the actual and the possible and seek to reconcile them. This attempt involves them in the linked processes of understanding, judging and explaining. Accordingly, the book opens with an examination of the quality of adolescent explanations and then turns to the factors which enter into the judging situation and the components of the act of judging. Finally, it discusses the improvement of judgment by tuition and the ancillary problem of concept formation in adolescence.

Peel sees understanding as basic to judging. It involves grasp of relationships, the use of higher level concepts, and the capacity for inductive argument. Judging is invoked whenever we have a situation for which we have no ready-made answer. As he shows, quoting a number of experiments, it exists at three broad levels—restricted, circumstantial, and comprehensive-imaginative. The latter represents its mature form and requires a constellation of intellectual abilities in the judge. It hardly exists before the age of 13, but begins to develop apace after this though even in adulthood "there always appear a residue of thinkers incapable of offering adequate explanations or making mature judgments." The ability to do so is investigated experimentally in terms of the effects of age, socio-economic status, and

instruction. A familiar obstruction to better judgment-making which can affect both immature and sophisticated thinkers—the difficulty they find in modifying established views—receives interesting attention here, and later the author indicates some of the ways of training or facilitating improved judging. One technique which is shown to help in this is the use of multiple-choice material.

The fascination of this book undoubtedly lies largely in the fact that it breaks new ground, but the readily assimilable manner of its presentation also deserves remark. The illustrative evidence (which may seem slight from some points of view) is fully set out and convinces by its consistency. Concrete quotations and examples as well as tabulations enable the reader to participate in the author's analysis and follow his argument. Some aspects which remain 'speculative and suggestive of future research' are acknowledged. Apart from these, every contention put forward has experimental support and in many cases has been the subject of intensive research.

One of the most interesting and crucial chapters deals with the process of making a judgment. First Peel discusses the arousal of the process—the stimulation of curiosity or interest. The evidence here shows the importance of conflicting information or strangeness in a situation. These disturb the thinker and promote attempts to resolve the problem by finding explanations. If the thinker's experience and insights are adequate, he will proceed to imagine and formulate hypotheses. The number of these is not the best measure of their worth, they must also be coherent and articulate. Inconsistency and partiality in the argument must be recognised and weeded out, and deductive reasoning will be required for the selection of the best solutions. All this demands a good deal of the thinker and needs practice and readiness.

Such findings as these have clearly much relevance to our often stated educational aim of helping the pupil to 'enter the world of ideas,' and the same is true of the whole book. The surprise is that psychological exploration of its subject should have been so long neglected. Now that it has been broached a spate of further studies can be expected, but Professor Peel's contribution seems likely to remain a basic text for some time to come.

O. C. SAMPSON.

RAPAPORT, D., GILL, M., and SCHAFER, R. (1970). *Diagnostic Psychological Testing*. Revised by Robert R. Holt. London: University of London Press, pp. 562, £6.50.

Dr. Robert Holt has edited and re-presented in one volume this pioneer handbook of diagnostic psychological testing. He has deleted the earlier accounts of research design and statistical analyses, while retaining the diagnostic signs which are supported by further clinical experience. He has contracted some of the test description and administration, but has added very many notes derived from changes in psychological testing and theory. A valuable list of David Rapaport's writings, as well as those of his students, has also been added.

The book shows how to use a selected battery of tests for the description and understanding of adults coming within a restricted range of neurotic and psychotic conditions. Dr. Holt gives much attention to rationale, and to diagnostic suggestions from specific test findings.

The test battery (Schaffer, 1948) comprises the Wechsler-Bellevue Scale (with an appendix on the WAIS), the Goldstein and Scheerer Sorting Test, the Story Recall of the Babcock and Levy Test, Word Association, TAT, and an extended treatment of the Rorschach (the latter being 47 per cent of the entire book).

In his excellent long foreword, Dr. Holt explains that the book does not aim at eclectic comprehensiveness, that it shows the application to tests of a single point of view (the psychoanalytic), and that it presents the mature wisdom of the man

who was virtually the dean of modern psychodiagnostic testing—David Rapaport. Important comments are made by the editor on clinical psychological testing, and he deals with a variety of criticisms arising, for example, from the work of Kelly and Fiske, and Meehl. He also discusses the basic difficulty of agreed criteria of validity in psychodiagnosis. On the nature of diagnosis itself he explains his view that "a diagnosis is not a sufficient classification but a necessary constituent of a personality description." As one of his main reasons in writing the long introduction, he mentions the feeling that he and other students of Rapaport had on re-reading the book, that "that wasn't really the way he did it." By this Dr. Holt means that the transmission of diagnostic skill is not completely achieved through prescription; he believes in the need for the kind of apprenticeship he himself experienced, and in support of this view he refers to Polanyi's discussion in *Personal Knowledge* concerning the hidden rules in the art of a skilful performance which cannot be specified in detail, but can only be assimilated in the apprenticeship situation.

The clarification and extended up-to-date information which Dr. Holt so finely presents, has resulted in a splendid revision of this classic text. His foreword is first class.

FLORENCE E. MACNEILL.

SCHAFFER, H. R. (Ed.) (1971). *The Origins of Human Social Relations*. London: Academic Press, pp., 297 £5.00.

The proceedings of a study group, organised in July, 1969, as part of a Centre for Advanced Study in the Developmental Sciences programme, are published here in a valuable book. There are 15 contributions from 21 authors covering a wide range of social phenomena in infants during the first two years of life. Most of the work is observational or normative and concerns the quality or quantity of mother-infant interaction in the first year of life, but two studies on non-human primates are included to provide comparative perspective. An interesting experimental contribution by Schaffer, demonstrating independent development in perceptual and motor systems, is included in a section on basic processes. A useful feature of the book are the discussions included after each contribution. Many of the points or queries which might occur to a reviewer are raised in discussion and in most cases answered. The discussions are valuable not only in making clear what we know but also in defining our areas of ignorance.

Implicit or explicit in a number of contributions is a problem concerning the 'ideal' parent-child relationship which should lead to 'stable' social relations in later life. Most contributors appear to favour a system of parent-child relationships which may be best described as middle-class Western European, and one author refers to it as 'normal.' Research is certainly a middle-class activity and there is some danger, apparent in this book, that investigators are unable to free themselves from their own systems of values. The difficulty may be illustrated through discussion of the chapter by Rosenblum in which he compares parent-child relationships in bonnet and pigtail monkeys. Pigtails are low in gregariousness, high in maternal protection and rejection, and respond with 'disturbance' and 'depression' to weaning and maternal loss. Bonnets come closer to the 'ideal' with their high gregariousness, low maternal protection and rejection, and 'minimal' response to weaning and maternal loss. If this research reflects more than laboratory artefact it demonstrates the *fact* that two species have adapted to the same biological problems in different, but presumably equally satisfactory, ways. There is no scientific reason for saying that one species is better adapted than the other. Differences in parent-child interactions between working-class and middle-class people or between home-raised or institution-raised people may also reflect similar adaptations and may even be based on genetic differences. Only Richards, in

pleading for a descriptive ecological approach, comes close to recognising the curious admixture of science and middle-class values which permeate this book. As a progress report on the recent state of research this is an excellent book, but clearly there is a long way to go.

JOHN WILCOCK.

WING, L. (1971). *Autistic Children*. London: Constable, pp. 157, £2.00.

It is about 30 years since the condition of autism was first described by Professor Leo Kanner. This book is written primarily as a guide to parents, but will certainly be of interest to many professional groups including teachers, psychologists, doctors, speech therapists and social workers. Its aim is the practical one of helping the autistic child to overcome his difficulties, develop what skills he has and help him to lead as full and happy life as is possible. Nor are the needs of the family of the autistic child forgotten.

It is impossible to understand and help an autistic child unless you know about the underlying problems which make it so hard for him to understand the world. The first section of the book gives a lucid and comprehensive description of these children. There is no blurring of the handicap, for as Lorna Wing says, from the point of view of the parents and children the label of autism implies serious handicaps and it is not in a child's best interests to make diagnosis unless there are good reasons. Most autistic children are below average in intelligence and many are severely retarded because the handicaps which underlie autism produce serious learning problems.

Having said this, she goes on to deal with the education and management of the autistic child. Her advice to parents and others working with autistic children is sympathetic, practical and encouraging, and those who have worked with autistic children will appreciate her endeavour to strike a workable compromise between too much rigidity on the one hand and too little structure on the other. She points out the necessity for determining the reason for each particular difficulty and then planning teaching methods on the basis of this knowledge. This attitude to the problems of autistic children is helpful both to the professional workers who may become too attached to a theoretical framework and to the parents who have too often been left with the feeling that there is little they can do to help their children overcome their difficulties and who consequently feel the weight of guilt associated with the birth of such a child more severely. Education and management in this section include the basic learning of reasonable behaviour and the simple skills of living. There is a refreshing honesty in her recognition of the difficulties encountered and the necessity for constant adult supervision and encouragement throughout life.

Lorna Wing's book should be of considerable practical help and encouragement to all those involved in the education of the autistic child. While not in any way denying the importance of professional help, it should be a great comfort to parents to know that they have a valuable role to play in the development of their child.

SHEILA CUMMING.

WOBER, M. (1971). *English Girls' Boarding Schools*. London: Allen Lane, Penguin Press, pp. 304, £3.50.

The publisher's blurb states, "This is an attempt to replace prejudice with observation and stereotype with real people." It is an attempt which succeeds, the author using well-chosen quotations from pupils' replies to bring the girls to life and making painstaking and scrupulously fair assessment of the data. The style is clear and concise and the book readable, though future research workers in that field might have welcomed more detail. The account probably gains in impact through being written in the first person.

In a quite interesting preview Wober surveys the field, though it is a little regrettable that at this early stage he includes comments on some of his findings. Presumably in deference to the requirements of the general reader a description of and commentary on the research methods is placed at the end. The main body of the book starts with a description of the system of girls' boarding schools and of the sample chosen for visitation, proceeding successively to an examination of goals, aspirations, happiness and success of pupils and schools, school life, intra-formal social control, pastoral care, the individual and the community, effects of boarding on family relationship and religion.

Procedure is by questionnaire to staff and pupils, asking for judgments on a three or five-point scale and giving an opportunity for free responses. This is a technique which, developed *in extenso* only recently, has re-vivified and made academically respectable the previously despised questionnaire. The pupils' judgments provide a statistical basis and their free responses interpret and deepen the meaning. Those free responses quoted are well selected to humanise the material and interest the reader.

There are one or two queries about the technique, e.g., a three-point scale seems too short for the range of happiness to unhappiness; the percentage reply of "between one third and one half" from teachers leads to misgivings about the value of this part of the results (though the author appreciates this), but on the whole the work is characterised by its balanced judgment and insight. It is of some interest that near the end of his 'overview' Wober states that of the 23 schools visited he would only be happy to send a daughter to six of them (though day schools might be in the same proportion), but it seems that though "girls are happy and getting a good education in the good schools, they may have something more to get from co-education."

R. R. DALE.

PUBLICATIONS RECEIVED

Books for review have been selected from the following. ("n.p." means "no price stated.")

- ADAMS, M. (1971). *Mental Retardation and its Social Dimensions*. New York and London: Columbia University Press, pp. 315, £4.75.
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- ARONSON, L. R., et al. (1972). *Selected Writings of T.C. Schneirla*. San Francisco: Freeman, pp. 1032, £10.20.
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- BANNATYNE, A. (1971). *Language, Reading and Learning Disabilities*. Illinois: Charles C. Thomas, pp. 787, \$20.50.
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The usual range of length of papers is from 2,500 to 4,000 words. Papers should be in a clear style and free from jargon. Statistical matter (formulae, tables, discussion of techniques, etc.) should be kept to a minimum, so that the *Journal* will be of interest to statistically untrained readers. Such concepts as mean, percentiles, standard deviations, correlation, chi-squared, standard error, critical ratio, significance and reliability, regression and factor analysis, can be employed in the text and need not be explained.

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